# AMERICAN MACHINIST

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## Collapsing Tap.

The tap which we illustrate herewith is designed for use in tapping pipe fittings, or other pieces where it is desirable that the tap be withdrawn directly after tapping to the proper depth. The chasers or threaded cutters are so arranged in the body of the tap as to be tripped after the tap has advanced the required distance, thus contracting the diameter so that the chasers are free, and the tap can be withdrawn without backing out.

The chasers are made circular in form, as shown. The seats for the chasers comprise two-thirds of a circle, so as to retain the chasers with certainty.

Upon the body of the tap is fitted a head or collar with two projecting handles. This head is provided with cams engaging the chasers, by means of which the chasers are brought into action, or withdrawn, according to the direction in which the sleeve is moved. A slight pressure only is required to move the chasers.

The body of the tap is made of steel and the chasers of best cast steel. The number of chasers varies with the sizes of the tap, which are from one inch up; they are made either with or without reamers for sizing the hole, as desired. When made with the reamer the time of changing tools in the machine is saved.

Kelly & Groves, 503 Fulton street, Elizabethport, N. J., are the inventors.

COLLAPSING TAP.

## Micrometer Stand.

The cut herewith illustrates a new device for holding micrometer calipers. Everyone who has had occasion to use this caliper, especially on small work, will, we should think, appreciate the advantages of this stand. It is simple, having but one screw, which clamps the caliper (of all makes) without marring, and at the same time binds the pivot pin, creating friction enough to hold the caliper vertically or inclined, as will be the most convenient for use. For instance, in sitting at the bench or machine the vertical position will be used; standing at the bench it will be inclined. Its advantages are, it leaves the hands free to use the screw and handle the piece. There is no danger of moving the adjustment of caliper, as frequently happens when it has to be laid on the bench or machine. The liability of getting the screw clogged with dirt is avoided, as frequently happens by lying on the bench, and there is less liability of injury to the caliper in many ways, as it stands clear of the bench and is much more handy to use, as there is room for the hand above the bench when holding a small piece of work to be measured.

The inventor informs us he felt absolutely forced to design something to facilitate the work of handling hundreds of pieces, and after a daily use of six months, and the approval of all who have seen it, he has concluded to manufacture for the market.

The base is handsomely japanned and ornamented with gilt striping, presenting a very neat appearance.

The manufacturer is C. E. Chandler, South Boston, Mass.

MICROMETER STAND.

Copper is said to lose 18 per cent. of its tenacity upon being raised from 60° to 360°.

The bursting of a copper steampipe on the English steamer Elbe, to which we have previously referred, has brought about a series of tests of the strength of copper, brazed similarly to the usual practice in making copper pipes, by Nisbet Sinclair. In fact, the tests were made from copper pipes and plates obtained from a leading coppersmith. The results of these tests appear to show that such pipes are likely to fail at pressure varying all the way between 20,000 pounds to 34,000 pounds per square inch of section, and that the brazed joint is about as strong as the solid metal.

The death of Prof. Balfour Stewart removes a man whose work has been of particular interest to the scientific world. Prof. Stewart was educated for a commercial life, but his attention was soon concentrated upon scientific subjects, particularly upon subjects connected with heat. In 1870 he received the appointment of professor of physics at Owens College. At the time of his death he was president of the Physical Society of London, and of the Manchester Literary and Philosophical Society. Professor Stewart was only fifty-eight years old at the time of his death.

## English Boiler Inspection.

BY W. H. BOOTH.

FIFTH PAPER.

In regard to stiffening rings for furnaces mentioned in my last paper, they have been found very effectual in strengthening long tubes against collapsing, and have been in great demand, when, by reason of the adopting of the compound system of steam engine, it has been necessary to employ higher pressures in the boilers, which, whilst perfectly fitted for such pressure in the shell, are not so strong against collapsing of the flues. The usual plan of stiffening is the application of one or more encircling hoops about the furnaces. If one, it is usually applied at about the mid-length of the furnace, whilst the second is placed slightly beyond the bridge. In the earlier days of hooping, the hoops were usually formed in halves, of angle iron, each half of slightly more than half a circumference, and so arranged that when in place the vertical legs of the angle irons came together, overlapping sufficiently to carry through rivets, as in Fig. 1 (page 2), or the method of Fig. 2 would be adopted, the two half rings butting endwise and being attached by a fish plate. In either case the rings were riveted hard and close drawn to the tubes, and they caused overheating by the double thickness of plate exposed to the fire, and were found also to be peculiarly liable to collect scale, which frequently completely covered and concealed the hoops. To remedy these defects, the rings were made some two inches larger in diameter than th tube to be encircled, and were attached by rivets passing through ferrule pieces, as in Fig. 3. This plan also was found not to be fully satisfactory, as there was great liability to leakage about the rivet heads on the fire side. The method finally hit upon, and which has proved most uniformly satisfactory, is that shown in Fig. 4. In this plan the hoops are made of larger diameter than the tubes, as in the method of Fig. 2, but their attachment is different. After being tightly connected by the fish plates and bolts, they are temporarily placed in position exactly concentric with the tubes. Thus fixed, holes are drilled through the plate corresponding with holes previously drilled through the hoop. These holes are then tapped through both hoop and plate by a sufficiently long tap, and screw bolts are then screwed through from inside the tubes. These bolts have rivet shaped heads and are slightly coned up to the underside of the head, so that when screwed home they make a tight joint in the plate. There is a temporary square head projecting from the head of the bolt, which is cut off when the bolt has been screwed up. Upon the bolt end, which projects through the horizontal leg of the hoop, is placed a nut tightly screwed up. No ferrules are used or required, the screwed thread holding the hoop securely in place.

It is clear that by this device there can be no overheating, and a minimum hold for scale and dirt. The tap bolts are placed at intervals of about seven inches, which is found sufficiently close to secure rigidity of the tube and prevent collapse, unless when overheated, and any furnace, however jointed or stiffened, will come down at the crown when overheated. A usual size of section of angle iron for these hoops is $3'' \times 3'' \times \frac{1}{2}''$, with screws of $\frac{7}{8}''$ or $1''$ diameter, coned up thicker under the heads.

There is considerable ignorance amongst engineers as to the action of hoops and the mode of their application. An English engineer of supposed high standing believes in simply placing a hoop a tight fit upon the tube, believing, apparently, that, as it will prevent outward distortion of any part, so it will render it impossible for any other part to come in. This is a great fallacy. No hoop, unless attached to the tube, can prevent collapse or even sensibly delay the collapse of a tube; for it is by no means a fact that collapse will choose just that portion of the tube under the hoop, and only in such case can such a hoop even pretend to utility.

The writer has found hoops of the form of Fig. 3, but wholly unattached. They were simply placed concentric with the tube, and held there by a few set screws, as in Fig. 5. The utter insufficiency of this method is too plain to require comment, it being worse with its few points of support than the tightly shrunk ring; for even the arch theory claimed for the latter cannot exist with the plan of Fig. 5. It is noticeable,

when the heads on the fire-side of Fig. 4 are of unusual size, they burn away somewhat, but not to a serious extent, only so far as renders them incapable of overheating—the parts which do overheat, by reason of their great projection, alone consuming. With Fig. 3, the ferrule induces a far greater extent of burning and the plate may and does become affected. In every sense, then, Fig. 4 is the best method of applying stiffening rings to weak furnace tubes.

### Are the Poor Becoming Poorer?

Whether it be fair to take the unemployed who have been holding demonstrations in London as true representatives of the working classes or not, their agitation is undoubtedly a symptom of the acute poverty which reigns in our great metropolis. Nowhere, in truth, can one be more forcibly struck by the contrast between wealth and poverty than in this country. Within the past fifty years the population of the United Kingdom has increased at the rate of 42 per cent.—from 26,000,000 in 1837 to 37,000,000 in 1887—but during that period the increase in wealth has been at the rate of 124 per cent., or nearly three times greater than the rate of increase in the population. Yet if the atmosphere and condition in which the humbler classes live are considered, it must be admitted that little or no headway has been made toward the elimination of the terrible destitution which is such a sad feature of our social life. Indeed, we appear to have gone backwards instead of forwards. The misery which abounds in our large centers of population, and the wretchedness of men, women, and children who cannot obtain sufficient clothes or bread, form a spectacle as appalling as any ever presented amongst us.—*London Times and Opinion.*

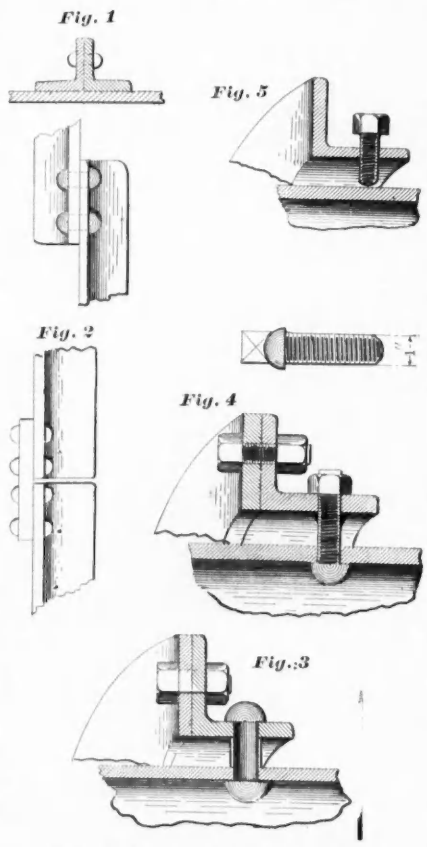
### Early Engineering Reminiscences.

BY GEORGE ESCOL SELLERS.

THIRTY-FOURTH PAPER.

Before closing the subject of paper making and its machinery, I propose giving some of my personal experience at a more recent period than what I have been writing of, hoping that by so doing it may be a warning to others not to accept theories for facts, however beautiful and and apparently perfect they may appear, without submitting them to close critical investigation and practical tests; for a single error once admitted, when discovered, knocks out the foundation and destroys the entire fabric erected on it; a case in point occurs to me:

Postlethwait Page, of some place in Ohio, made his appearance in Philadelphia sometimes wearing a crimson toga and mitered head dress—styling himself the High Priest of Nature, and believing himself to be a second Christ. He was a man of a high order of intellect, and upon other subjects perfectly sane. Dr. R. M. Patterson, a professor in the Pennsylvania University, and for many years Director of the United States mint, expressed to me a desire to meet and study this man; he had heard much of his mathematical attainments. As I knew Page, and frequently saw him, I proposed to the doctor to name an evening that he could come to our house and bring any of his friends, and I would have Page there to meet them; this was done, and the doctor came, accompanied by my uncle, Franklin Peale and Professor John K. Mitchel. Soon Page, in his robes, came in, presenting a majestic appearance, and when he removed his miter no one could look on his clear-cut features, his expressive eyes, broad, high, noble forehead, and for a moment suspect lunacy. For some time the conversation was general and very interesting, but soon Page, knowing the high estimation in which Dr. Patterson was held as a profound scientist and mathematician, directed his attention particularly to him, showing an evident desire to make a favorable impression. Paper and pencil were soon called for, over which he and the doctor soon had their heads together. Page was a rapid sketcher, and still more rapid with figures, while all the time words were pouring from his lips like a never-ceasing cataract; often quotations from Scripture, giving chapter and verse, and always with an apt application. Squaring the circle, to us outside listeners, appeared to be the theme. It was evident that the doctor could not keep up with Page, and frequently brought him back for explanations. At last he said: "I see it now, it is very clear." I reached forward and made a strong pencil mark at the figures where this exclamation of the doctor's came in. It was followed by the doctor frequently saying, "Yes, yes, I see it very plainly." When a second sheet of paper was worked out, I, unperceived by Page, removed and secreted the marked one—for I knew enough of Page to see his cunning drift. After several sheets of paper had been sketched and figured over, Dr. Patterson exclaimed: "It is wonderful, really wonderful." Then Page majestically arose, and for the first time made his insanity patent to all by saying: "Doctor, I thank you for your close and untiring attention. I must now beg you to excuse me for tearing myself away, as I have an important engagement; but, doctor, I shall do myself the pleasure of calling on you, and would be




BOILER INSPECTION.—SEE PAGE 1.

under lasting obligations if you would append your address here," pointing to a space at the bottom of the last sheet of paper used. The doctor wrote his name in full, with his house and office address. Then, as Page gathered all the papers together, he continued, "As I said, I have an important engagement. You see, gentlemen, I hired the carriage by the hour, and there is barely time to take me to my lodging. If I do not tear myself away that fellow will stick me for another hour. It is the way they have; but this will change when I assume my scepter and appear in my true character; then all the world will be at my feet and service." As he bowed himself out Prof. Mitchell exclaimed, "Mad as a March hare, and, doctor, he has caught you finally; he has your acknowledgment, in your own hand, appended to his vagaries, and take my word for it he is cunning enough to use it to his advantage." The doctor, who was an extremely sensitive man was greatly annoyed. I handed him the sheet of paper that I had secured, and pointed to the marked place where he had made his first admission, that he might work back and discover the error, or rather the adroit change of probably a single figure, that the cunning lunatic knew would produce the result he would impose on the doctor, to gain his first admission. This, by his great volubility and rapid figuring, was comparatively an easy task. It did not take many minutes to verify this supposition, but the discovery only added to the doctor's mortification, for when discovered it was so plain that he did not see how he could have overlooked it. He felt that he had been under a spell, and had been carried away by the man's self-confidence, apparent candor and sincerity. Mr. Peale had noticed that when Page collected together and appropriated the papers that had been scribbled on, that he evidently missed something, and suggested that he most probably would be around in the morning, looking for the lost link; then some mode must be devised to get the sheet with the doctor's signature out of his hands. I will only state that this was successfully done, greatly to the relief of Dr. Patterson.

My case was hardly parallel, for it was not one of deception, but was from results produced by a certain mode and believed to be in accordance with an unerring theory, beautiful in conception, and apparently so plain as not to admit of a doubt. I think it was in the latter part of the year 1858, that my attention was first attracted by a newspaper notice of a new mode of separating or disintegrating the fibers of wood, flax and other fibrous plants, by a sudden discharge or escape from steam cylinder engines under high pressure, and that for a practical test a steam gun had been constructed at the Novelty works, New York, and had been successfully operated at Elizabethtown Point, New Jersey. It was by a premature discharge of this gun that Mr. William Allen, brother of Horatio Allen, the well-known engineer, at that time connected with the Novelty works, lost his life. That lamentable occurrence gave widespread publicity to the process and the tests then being made.

Sometime in the year 1859, Mr. Horatio Allen presented me with specimens of matted tangled strings of fiber of cane, (arundinaria microsperma) from the great canebrakes of the Southwestern States, as discharged from the gun, also specimens of the ultimate fiber separated, purified and bleached, and also of paper made from it. This was not bleached to a clear white, but was in color much like the India paper on which proof impressions of engravings are printed, and similar in texture and silky feel. At the same time he presented me with an impression from a steel or copper plate engraving—a likeness of Edward Everett, the print that was gotten up for the Mt. Vernon Association. This showed the paper for that purpose to be equal to the finest India paper.

The theory, as then explained to me, was, the moisture or liquid sap contained within the cells or interstices of the green plant, being heated under pressure of some 200 pounds or about 380° Fahrenheit, would, when suddenly relieved of the pressure, flash into steam with such violence as to completely disrupture the plant. The promulgator of this theory, and inventor of the mode of operating, was Mr. Azel S. Lyman, of New York, who took out letters patent for the process in August, 1858. Mr. Allen represented to me that it was the intention of certain parties to put it into operation on an extensive scale, and thus to utilize a portion of the vast and almost useless canebrakes of the Southwestern States, as an inexhaustible source of supply of the finest quality of paper stock for the entire world.

I heard nothing more of this until the spring of the year 1862. At that time my home was on the banks of the Ohio river, on the Illinois side, about 12 miles below Shawneetown, in a country much of which had been reclaimed from the cane that grew spontaneously in every favorable location, even extending from the bottomlands to the rocky hills, taking possession of every spot offering a roothold. I had made Mr. Allen acquainted with these facts.

In consequence of the civil war, the difficulty of obtaining foreign paper stock, paper of all kinds had doubled its cost to the consumer. This was a favorable time to look towards the inexhaustible canebrakes for a new home supply, if they could be made available; but unfortunately the great bulk of the canebrakes were inaccessible, being within the field of active military operations. It was early in the year 1862 that I received a letter from Mr. Horatio Allen inquiring as to the probable extent of cane in my vicinity that could be relied on as a source of supply outside of the interference of active hostilities. This brought about an examination that resulted in finding detached patches on several of the islands of the Ohio river, and on the unimproved, low bottomlands of the Wabash, the Saline river, and other tributaries of the Ohio on its north side; but this cane was small in comparison with that of the great canebrakes, ranging from 15 to 20 feet in height, but more of it under than over 15 feet.

I computed from the best data I could obtain, that it could be cut and transported to a favorable point on the Ohio, where coal for fuel couid be mined at a cost of about $6.00 per ton. About the time I gave this information to Mr. Allen I was called East, and then had several interviews with him, and learned that the Lyman patent was owned by an association, of which he was trustee, with entire control. At one of these interviews he gave me a quantity of the crude cane fiber, as produced directly by being discharged from the steam gun, which in a dry state was represented as being about 75 per cent. of the green cane. The final loss by the ultimate separation of these long strings or bundles of fibers, their purifying and bleaching for paper stock, had not been arrived at on a sufficient scale to be fully relied on. But, from what had been done, Mr. Allen thought it had been demonstrated that the loss from green cane would not exceed that of rye straw on being converted into white paper stock, and the product greatly superior to either straw or wood fiber.

These various interviews resulted in my entering into an agreement to erect works and prosecute the business of manufacturing paper stock from cane.

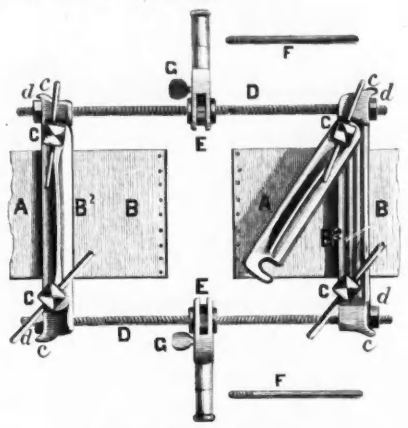
I now have before me a copy of the agreement that was entered into between Horatio Allen as trustee and myself, on the 12th of April, 1862. By it was conveyed to me the exclusive right to use "the machines, processes and inventions for the full term of the patent, reissues, renewals or extensions, within the States of Ohio, Indiana, Illinois, Wisconsin, Iowa, Missouri, Mississippi, Louisiana, Texas and the counties of Virginia lying on the Ohio river, for the purpose of making what is known by paper makers as "half stock." The right to construct disintegrating cylinders or guns, and other instruments under the said patent and invention, within the said States, but not to supply any of the product of said cylinders or guns to be worked up outside of said States, with the exception of five tons per day, which may be worked up in the State of Pennsylvania; the agreement also provided that I should, without delay, put in operation at any location on the Ohio river, that I should select at least two disintegrating cylinders or guns, and have the same in full operation within nine months from date of contract. There was also a provision to regulate the number of guns to supply the full demand for their products. The royalties were fixed on a sliding scale, say "one-half of one cent per pound when the market value at the place of manufacture exceeds the cost at least two cents per pound, and one-eighth of a cent per pound when the market value at the place of manufacture exceeds the cost not more than half a cent per pound, and when the market value at the place of manufacture exceeds the cost by a sum intermediate between two cents and half a cent per pound—a royalty at a *pro rata* rate to the royalties already specified." There was another provision that the half stock was to be in a dry state, and the cost of producing it to include "the cost of cane or other fibrous plant, fuel, labor, wear and tear, insurance and clerk hire of the works, and working expenses, such as oil, lights, etc., but not including salaries of officers of a company, or interest on capital invested in

lands, buildings, machinery and other outlays of a permanent character."

On entering on this agreement I was fully aware that the gun disintegrating process, as secured by patent, was but the foundation stone on which the structure was to be erected; the bundles of fiber, as produced by the guns, being in but little, if any better condition for paper stock than well dried rye straw; but the stock, when purified and bleached, was so infinitely superior that the market value would warrant all the labor and expense that, from the data furnished, I estimated it would cost to produce it, and I did not doubt my ability, considering the long experience I had with paper making machinery and processes, of being able to accomplish it at a cost that, at the then value of paper stock, would leave a large margin, and, as paper stock would necessarily decrease in value on the cessation of hostilities and opening the ports to foreign stock, I believed the facilities in handling, the perfecting of machinery and processes, would keep pace with the decline; but, to guard against miscalculations, the sliding scale in the royalties, as above stated, was insisted on.

I had a clear understanding with Mr. Allen that the tangled strings of fibers, as produced by the gun process, were not considered half stock, but the further disintegration and bleaching was to be gone through with, to produce a stock ready to be finally beaten in the finishing engine and made directly into paper, either alone or mixing with rag or other stock that had been brought to the same condition, known by paper makers as half stock. No plans of operation beyond the gun process were furnished me. The agreement, as I have before stated, said the half stock was to be estimated in a dry state, for if shipped wet to the consumer there would not only be loss in weight, but additional cost in transportation; therefore plans were to be devised for drying and putting into convenient form for transportation and use.

I could see no other way of arriving at the commercial value of the stock than by having it converted into paper, and as there were no paper mills within a reasonable distance of the site selected for the fiber works, with the full concurrence of a party who had become associated with me in the enterprise, we purchased steam engine and boilers, a cylinder paper machine, with dryers and all the necessary appurtenances, and at once commenced the erection of a paper mill. All this machinery was shipped from Philadelphia, during the month of June, and arrived at Seller's Landing, Hardin county, Ill., on the 17th of July, just before the guerrilla warfare seriously interfered with running steamboats on the Ohio river. Two disintegrating guns, with steam boiler, were contracted for at the Novelty works, at the time of closing the agreement with Mr. Allen as trustee. No definite time was named for the delivery of the guns, but Mr. Allen spoke confidently of their being ready to forward before the 1st of June, and to forward matters I was furnished with drawings of the wooden frames or carriages in which they were to be mounted—all of which was prepared in advance, including the building of a great gun room. From some cause I do not now recollect, the guns and boilers did not reach Evansville, Ind., until about the 1st of October, at a time that no transportation on the river could be had. On the 7th of that month I went to Evansville and found a number of river steamboats laid up, owing to the guerrilla warfare against them on the lower Ohio, and that it was then impossible to freight the guns to our landing, at any cost. The Gen. Pillow, a small gunboat, had been stationed between our landing and the coal mines on the Kentucky side of the river, to protect the government transports while coaling, and also, at our solicitation, to protect our works. Notwithstanding this, a large body of guerrillas crossed the river in the night, some distance above the gunboat, descended through the woods to our landing, committing depredations and doing considerable damage causing a total suspension of the work until the last of the month, when a detachment from a regiment then quartered at Shawneetown was placed there for our protection. Then the work on the paper mill was resumed, and prosecuted with all the force that could be obtained, and kept at work during the troubled times. The guns and boiler were still lying at Evansville, waiting for transportation.




**Ainsworth's Belt Clamp.**

These clamps, for stretching and lacing belts, are made of cast-steel, well fitted and finished. They are complete in themselves, the use of no tool or wrench being required.

In the engraving *A* and *B* represent the ends of the belt, and $B^2$ the clamp bars, which are provided with corrugations to prevent slipping of the belt. *D*, *D* are rods with right and left hand screws by which the ends of the belt are drawn together, by means of ratchets *E*, *E*. By turning thumb screws *G*, *G*, the ratchets will work right and left hand, as desired. *F*, *F* are extension handles for the ratchet handles.

The manufacturers of these clamps are the Moore & Barnes M'f'g Co., 103 Chambers street, New York.

## A Good Example.

The sons of the late Edward Stabler, of Sandy Spring, Md., have just presented to Swarthmore College the foundry of their father, with all its appliances and patterns. In this foundry was cast all the metal work of the presses and seals made by him for the various State and city governments, corporations and courts of law throughout the country, for the several departments of the national Government in Washington, and for its consular agents all over the world. Here, too, were made the steel dies for the gold and silver medals of the Maryland Institute, and many other works of a similar character. This valuable gift will become a part of the foundry of the department of enginering and the mechanic arts at the college, and will add largely to the means of instruction in this direction.—*Public Ledger* (Philadelphia).

The *Railroad Gazette* points out what it assumes is a glaring defect in the design of the cylinders of stationary engines, viz.: jacketing the cylinder with exhaust steam. We remember that there was a little—not much—of this practice about twenty years ago, but the error was at once pointed out, and we should be surprised to know that it was practiced by any reputable builder of the present time.

*Nature* describes a new way of utilizing dynamite, lately devised by Mr. Bonnetond, a French military engineer, who uses the expansive force to drive out, for a brief period, the water from portions of wet ground in which foundations are to be made. The method is now in practice in the construction of a fortified *enceinte* at Lyons. A hole is first bored 10 feet or 12 feet deep, and about 1½ inches wide, in the wet ground. Into this is passed a string of cartridges or dynamite, which is then exploded. The water is thus driven far out beyond the sides of the cavity, over a yard wide, which is produced, and it does not reappear till after half-an-hour at least. The workmen thus have time to clear the cavity and introduce quickly-setting concrete. When the water returns it cannot injure the foundation. A rapid rate of progress is realized by this method.

## Hine's Eliminator.

The apparatus which we illustrate herewith is for the purpose of separating oil, grease and foreign matter from exhaust steam and also water from live steam.

The gain from using exhaust steam for heating purposes is well understood, but its use has developed an important obstacle, viz., the coating of the interior surfaces of pipes and radiators with grease used in lubricating the cylinder and rods, thereby greatly impairing the efficiency of the radiating surfaces, and frequently causing to be emitted offensive and unwholesome odors. It is also well known that in returning the water of condensation to the boiler from heating pipes when exhaust steam is used, grease is carried into the boiler, working material injury, so that this water, although at a high temperature and of a desirable quality, in that it is free from dirt and scale-making properties, is generally allowed to go to waste.

Many manufacturers, prominent among whom are paper makers, could affect a material saving by using direct exhaust for heating water, but are prevented from doing so, in consequence of the oil contaminating the water into which the exhaust is directed. The troubles experienced by engineers in working condensing and exhaust injectors are likewise well understood. To overcome the difficulties named, and others, is the object for which this apparatus is devised.

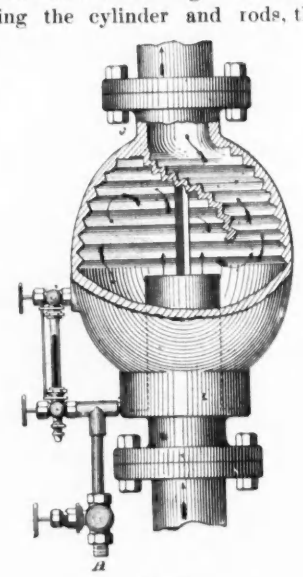



Fig. 3.

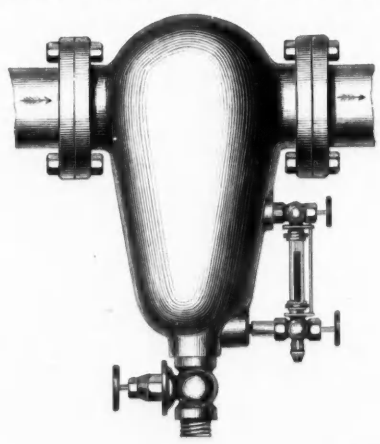


Fig. 1.

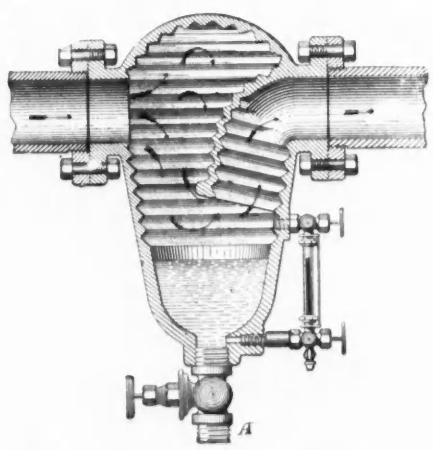



Fig. 2.

HINE'S ELIMINATOR.

By referring to the engravings, the special features of the apparatus will be understood, Fig. 2 is for horizontal and Fig. 3 for vertical connection. It is set in the exhaust pipe from engine or pump, as convenience will allow. It will be seen that the exhaust steam upon entering the eliminator instantly expands, and impinging the corrugated and otherwise roughened surfaces, breaks up; the entrained oil, grease and dirty water being expelled, adhere to the inner roughened surfaces, and gravitate to the bottom of receiving chamber, and are discharged through the drain valve "A" which should always be left sufficiently open to allow a free passage of the oil and dirty water, while the clean dry steam, deflecting from the face of the depending partition, is driven first down then upward in continuous contact with the roughened corrugated surfaces in its course. It will be noticed that the construction is such that no back pressure can be produced by its use. The steam has opportunity to expand in the chamber, and impinging surfaces are so arranged that the steam will be broken up and brought in contact with these surfaces.

By extending a pipe from valve *A* into a sub receiver, such as a barrel or tank, it will be found that oil thus deposited is in no way impaired and can be used over again, care being taken to keep dirt out of the tank. As considerable water from condensation is discharged with the oil passing together into the receiving tank, the oil being the lighter will float (and can be skimmed or drained off, affecting thereby a saving of the cylinder oil, a material item), while grit or dirt, if any, being heavier than the water, will sink to the bottom and be carried off when draining the receiving tank.

The advantages claimed for this apparatus by the inventor, and which he is willing to submit to trial, may be briefly summed up:

Clean dry steam, for any and all purposes for which engine or pump exhaust can be used. Clean heating pipes, radiators and valves, consequently better radiation and positive relief from unwholesome and obnoxious odors incident to oil-coated pipes and valves. By its use, the condensed water from the exhaust is kept pure, and can be used over again in the boilers instead of being discharged into sewers, as is commonly done in exhaust heating. Saves coating roofs and obstructing skylights with oil, grease and dirty water. Prevents exhaust injectors from clogging with oil, and oil from passing through them into boilers. Being placed in live steam pipes, it will eliminate entrained water, delivering dry steam to engine or pump.

The manufacturers are Hine & Robertson, 45 Cortlandt street, New York.

The great political engineers are getting their machinery ready for service in the coming presidential contest. Such a contest, it is generally considered, will damage business to some extent. Our opinion is that this ought not to be so. Whichever party succeeds, it is as certain as anything can be, that harvest will succeed seed-time. In the light of the past, for nearly one hundred years, it is, to put it mild, silly to suppose that any party can, by its success in a presidential contest, materially affect the business of the country. A change in the price of coal of twenty-five cents a ton will have infinitely more to do with manufacture than will the question of who shall be the next President of the United States.

W. Putnam, of Darlington, England, has patented what he undoubtedly believes to be an improvement in the construction of cranks and crankshafts. The webs of the crank are built up of laminated plates, by which it is claimed that far greater elasticity is obtained; also, that should the strain be excessive, one or more of the plates will give warning by buckling.

## Practical Drawing.

BY J. G. A. MEYER.

FORTY-SECOND PAPER.

*Problem* 54.

394. TO FIND THE PROJECTIONS OF A COLLAR NUT, ITS SIZE AND POSITION IN SPACE BEING GIVEN.

In this problem it is required to find the vertical and horizontal projection of a nut suitable for a bolt one inch in diameter; the axis of the bolt is parallel to the vertical plane of projection, and making an angle of 60 degrees with the horizontal plane of projection. The depth of the hexagonal part of the nut is to be 1 inch, the depth $g\,k$ of the collar $\frac{3}{8}$ of an inch, and the diameter of the collar is to be equal to the distance $g\,j$ across corners.

In all problems of this kind we must always draw first that projection of an object which can be drawn without any reference to any other projection. With the aid of the rules given in Articles 384 and 387 we can at once determine the distance between the lateral edges in Fig. 278, and since the axis of the bolt is to be parallel to the vertical plane of projection, we shall commence our problem by finding the vertical projection of the nut.

Our first step will be to find the dimensions of the hexagonal part of the nut, namely the perpendicular distance between two of its parallel sides, which is found by the rule given in Art. 384; and the distance across corners, which is found by the rule given in Art. 387. Hence we have for the

perpendicular distance between two parallel sides } $1'' + \frac{1}{2}'' + \frac{1}{8}'' = 1\frac{5}{8}''$

and for

the distance across corners } $1\frac{5}{8} \times 1.155 = 1\frac{7}{8}$ inch.

According to the conditions given in the problem, the diameter of the collar is to be equal to the distance across corners of the hexagon, hence the diameter will be $1\frac{7}{8}$ inch. The depth of the collar, namely $\frac{3}{8}$ of an inch, is given, and also the depth of the hexagonal part, which is to be 1 inch. Here then we have all the dimensions needed for making both projections.

Draw a horizontal line $A\,B$ and let this line represent the ground line. Draw the center line $q\,t_6$, making an angle of 60 degrees with the line $A\,B$; part of the line $q\,t_6$ will represent the axis of the bolt; perpendicular to this line draw the line $g\,j$ and let it represent the bottom of the hexagonal part; then proceed and draw around the center line $q\,t_6$, and and on the line $g\,j$ as a base, the hexagonal part of the nut, by a method precisely similar to that given in Art. 390. The only difference between the projection in Fig. 274 and that represented in Fig. 278 is that, in the former, the nuts are represented in a vertical position, and in the latter the nut is represented in an oblique position. The lines representing the lateral edges of the nut in Fig. 278 must be drawn parallel to the center line $q\,t_6$, and the lines $g\,j$ and $v\,w$ perpendicular to $q\,t_6$. To draw these lines quickly and conveniently, use the T-square and the set square as shown in Fig. 146, and explained in Art. 194. The curve $d\,t\,e$ is drawn from the point $u$ as a center; the curves $c\,m\,d$ and $e\,n\,f$ are drawn in a manner as explained in Art. 390. The arc from $o$ to $p$ is also drawn from the point $u$ as a center and represents the end of the bolt projecting through the nut, and therefore the distance from $o$ to $p$ must be equal to 1 inch. Parallel to $g\,j$ draw the line $k\,l$, the distance between these lines must be equal to the depth of the collar, namely, $\frac{3}{8}$ of an inch; prolong the line $c\,g$ to $k$, and the line $f\,j$ to $l$. The rectangle $g\,j\,k\,l$ will represent the vertical projection of the collar, or if we consider this collar separately, we may say that the rectangle $g\,j\,k\,l$ represents the vertical projection of a cylinder $\frac{3}{8}$ of an inch deep and $1\frac{7}{8}$ inch in diameter. This rectangle completes the vertical projection of the collar nut.

In order to find the horizontal projection we first draw the center line $k_2\,f_2$ parallel to, and at any convenient distance below the ground line $A\,B$. Through the point $g$ (Fig. 278) draw a vertical line cutting the line $k_2\,f_2$ in the point $g_2$; also through the point $c$ draw a vertical line cutting the line $k_2\,f_2$ in the point $c_2$. The line from the point $g_2$ to the point $c_2$ will be the horizontal projection of that edge of the nut whose vertical projection is the line $g\,c$. Our next step will be to find the horizontal projection of the edge $h\,d$, and also the edge which is hidden by, or coincides with the edge $h\,d$. The distance between these two edges is equal to the perpendicular distance between two parallel sides of the nut, and this distance we found to be $1\frac{5}{8}$ inch. Consequently, in Fig. 279, draw a line $h_2\,e_2$ parallel to center line $k_2\,f_2$; the distance between these two lines must be equal to $1\frac{5}{8}$ inch (one half of the distance between parallel sides). Above the line $k_2\,f_2$ and parallel to it, draw the line $h_3\,e_3$; the distance between $k_2\,f_2$ and $h_3\,e_3$ must also be equal to $1\frac{3}{8}$ inch. Through the point $d$ draw a vertical line cutting $h_2\,e_2$ in the point $d_2$, also cutting the line $h_3\,e_3$ in the point $d_3$. Again, through the point $h$ draw a vertical line, cutting the line $h_2\,d_2$ in the point $h_2$, also cutting the line $h_3\,d_3$ in the point $h_3$. The line $h_2\,d_2$ will be the horizontal projection of the edge which is represented by the line $h\,d$ in the vertical projection; and the line $h_3\,d_3$ will be the horizontal projection of the edge which, in the vertical projection, coincides with, and is hidden by the line $h\,d$. Through the point $e$ draw a vertical line, cutting the lines $h_2\,e_2$ and $h_3\,e_3$ in the points $e_2$ and $e_3$ respectively. The point $e_2$ will be the extremity of the edge represented in Fig. 278 by the line $i\,e$; and the point $e_3$ will be the extremity of the edge which in Fig. 278 is hidden by the line $i\,e$. The points $d_2$ and $d_3$ are also extremities of the edges represented by the line $h\,d$ in Fig. 278. In this figure the extremities $d$ and $e$ are connected by the arc $d\,t\,e$, and since this arc is parallel to the vertical plane of projection, it must be represented in the horizontal projection by a straight line; and since in Fig. 279 the points $d_2$ and $e_2$ are the horizontal projections of two points in the same arc, it follows that the straight line $d_2\,e_2$ is the horizontal projection of the arc $d\,t\,e$. For similar reasons the line $h_3\,e_3$ is the horizontal projection of that arc which is hidden by, and coincides with the arc $d\,t\,e$.

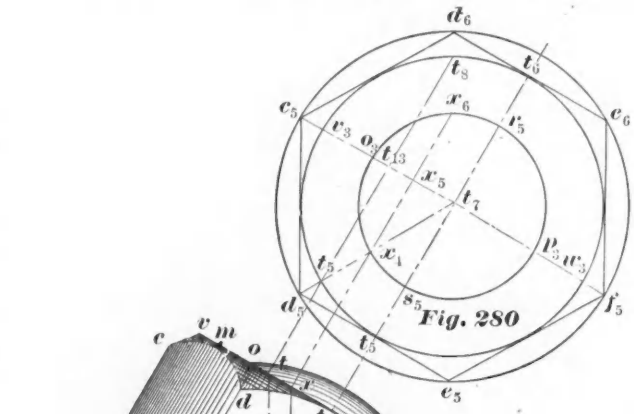
We must now find the horizontal projection of the curved edge which is represented in Fig. 278 by the arc $c\,m\,d$. This arc is tangent to the line $v\,w$, and the point of tangency $m$ lies in a line drawn midway between lines $g\,c$ and $h\,d$; and consequently the point of tangency in the horizontal projection must also lie in a line drawn parallel to and midway between the lines $g_2\,c_2$ and $h_2\,d_2$. Now this much established, we can easily find the horizontal projection of the point $m$, thus: Through the point $m$ draw a vertical line, also midway between the lines $g_2\,c_2$ and $h_2\,d_2$, and parallel to the same, draw a straight line cutting the vertical through $m$ in the point $m_2$; this point will be the horizontal projection of the point $m$. But the extremities $c_2$ and $d_2$ of the edges $g_2\,c_2$ and $h_2\,d_2$ are also the horizontal projections of the points $c$ and $d$ in the curve $c\,m\,d$; we may therefore assume that in Fig. 279 we have three given points $c_2$, $m_2$ and $d_2$ of an arc of a circle, and this arc will be the horizontal projection of the arc $c\,m\,d$. Hence, join the points $c_2$, $m_2$ and $d_2$ by an arc of a circle; to do this follow the method given in Art. 125, Problem 12. In a similar manner, and for similar reasons, draw the arc $c_2\,m_3\,d_3$, which is the horizontal projection of the arc hidden by the arc $c\,m\,d$. In connection with describing the arc $c_2\,m_3\,d_3$ it may be said that the point $m_3$ is the point in which the line drawn parallel to, and midway between the lines $g_2\,c_2$ and $h_3\,d_3$ cuts the vertical line drawn through the point $m$.

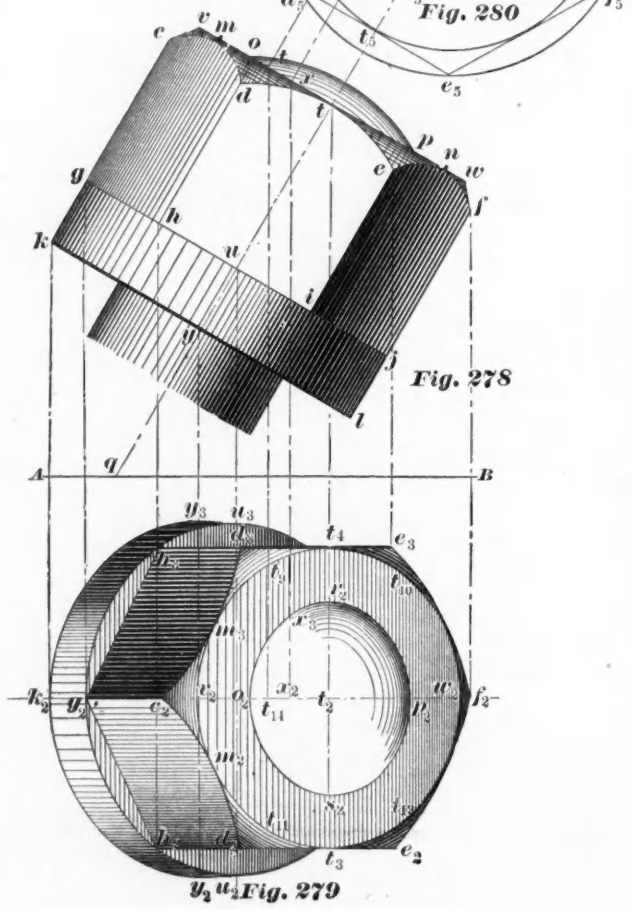
Join the points $g_2$ and $h_2$, also $g_2$ and $h_3$ by straight lines. The line $g_2\,h_2$ will represent the lower extremity of the side $g_2\,c_2 h_2$, $d_2$, and the line $g_2\,h_3$ will represent the lower extremity of the side $g_2\,c_2\,h_3\,d_3$.

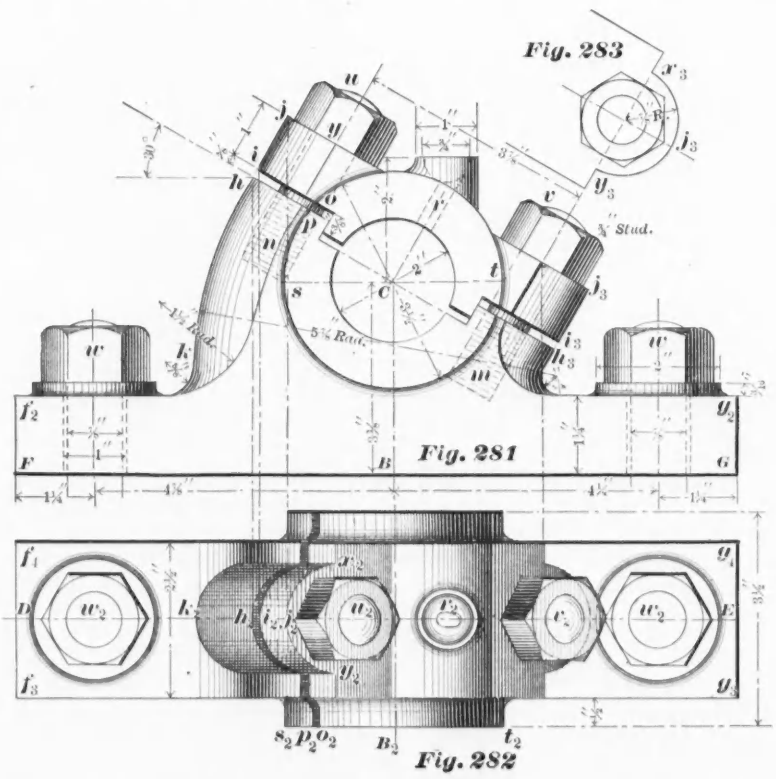
Our next step will be to find the horizontal projection of the arc $e\,n\,f$. Through the point $f$ draw a vertical line, cutting the line $k_2\,f_2$ in the point $f_2$. Then, with the same radius used for drawing the arc $c_2\,m_2\,d_2$, describe an arc passing through the points $e_2$ and $f_2$; also with the same radius describe an arc passing through the points $e_3$ and $f_3$. The arc $e_2\,f_2$ will be the horizontal projection of the arc $e\,n\,f$, and the arc $e_3\,f_2$ will be the horizontal projection of the arc hidden by $c\,n\,f$.

Now find the horizontal projection $v_2\,t_4\,w_2\,t_3$ of the circle in which the chamber intersects the upper surface $v\,w$ of the nut. To do this follow the instructions and methods given in Problem 51. It may be well here to remind the student that because the arc $d\,t\,e$ is tangent to the line $v\,w$, the diameter of the circle whose horizontal projection is now to be found, will be equal to the distance between two parallel sides of the nut, namely $1\frac{5}{8}$ inch, and consequently the distance between the points $v$ and $w$, which represents the diameter of the same circle, must be equal to $1\frac{5}{8}$ inch. By the same method as given in Problem 51, find the horizontal projection $o_2\,r_2\,p_2\,s_2$ of the end of the bolt $o\,p$. For the sake of simplicity consider the end $o\,p$ to be a circle 1 inch in diameter.

We must now find the horizontal projection of the collar $g\,j\,k\,l$. Let us commence by finding the horizontal projection of the upper edge $g\,j$. Through the center $u$ draw a vertical line; on this line lay off two points $u_2$ and $u_3$; the distance of each one of these points from the center line $k_2\,f_2$ must be equal to one-half the diameter $g\,j$; that is, $\frac{15}{16}$ of an inch. Now, since the diameter of the collar is equal to the distance across corners, the points $h_3$, $g_3$ and $k_3$, previously found, must also be points in the horizontal projection of the edge $g\,j$, which, according to Art. 376, must be an ellipse. Therefore, from a point on the major axis $u_2\,u_3$ as a center, describe an arc which will pass through the points $u_3\,h_3$; and with the same radius, and a point on the major axis as a center, describe an arc passing through the points $u_2\,h_2$; again, from a point as a center on the minor axis, describe an arc which will pass through the point $g_2$, and be tangent to the arcs previously described. In a similar manner find the horizontal projection of the




NOTE.—A short arc described with a radius of $1\frac{7}{8}$ inch from the center $C$ and terminating at the line $j\,j_3$, lying above the same, has been accidentally omitted in Fig. 281.

lower face or base $k\ l$, which will complete the horizontal projection of the nut.

395. Considerable time may be saved in constructing the ellipse $v_2\ t_3\ w_2\ t_4$ (which is the horizontal projection of the circle in which the chamfer intersects the upper face $v\ w$ of the nut) by adopting the following method. This method, as will be seen, differs nowise in principle from that given in Problem 51:

Draw a view of the nut, such as shown in Fig. 280. This view, and such views as will be given hereafter for similar purposes, we shall call auxiliary projections. In drawing this projection the center $t_7$ must lie in the center line $q\ t_6$. The inscribed circle $v_3\ t_5\ w_3\ t_6$ represents in this projection the limit of the chamfer, and is the circle whose horizontal projection is represented by the ellipse $v_2\ t_3\ w_2\ t_4$ in Fig. 279. Join the vertex $d_5$ and the center $t_7$ by a straight line, cutting the circumference $v_3\ t_5\ w_3\ t_6$ in the point $t_5$; through this point draw a line $t\ t_8$ parallel to $q\ t_6$, cutting the circumference of the circle in the point $t_8$, also cutting the line $v\ w$ in the point $t$, and the line $c_5\ f_5$ in the point $t_{13}$. Through the point $t$ draw the vertical line $t\ t_{14}$, cutting the line $k_2\ f_2$ in the point $t_{14}$ on the vertical line through this point lay off from $t_{14}$ a point $t_9$; the distance between these points must be equal to the distance between the points $t_{13}$ and $t_5$, or that between the points $t_{13}$ and $t_8$. From a suitable point as a center on the major axis describe the arc $t_9\ t_4\ t_{10}$, tangent to the line $d_3\ e_3$, and passing through the point $t_9$; with the same radius, and from a point as a center on the major axis, describe another arc, tangent to the line $d_2\ e_2$. From a suitable point as a center on the minor axis describe an arc passing through the point $r_2$ and tangent to the two arcs $t_9\ t_4\ t_{10}$ and $t_{11}\ t_5\ t_{12}$; and with the same radius, from a point as a center on the minor axis, describe an arc passing through the point $w_2$. This will complete the horizontal projection of the inscribed circle shown in Fig. 280. In a similar manner the horizontal projection $o_2\ s_2\ p_2\ r_2$ of the end of the bolt can be found, the lines and letters clearly indicating the method, so that in this case further explanation is unnecessary.

396. *Remarks.*—If the ellipse $v_2\ t_3\ w_2\ t_4$ is very accurately drawn, and the curves $c_2\ m_2\ d_2$, $c_2\ m_3\ d_3$ also accurately constructed, the ellipse will be tangent, or in other words, touch the curves in the points $m_2$ and $m_3$. But an ellipse, or rather a so-called ellipse which is composed of arcs of circles, is not absolutely accurate, although, as we have stated before, sufficiently accurate for many practical purposes. Again, if the arc $d\ t\ e$ in Fig. 278 is really a true arc of a circle, the projection $c\ m\ d$ of a similar arc cannot be an arc of a circle, as we have shown it to be, neither can the curves $c_2\ m_2\ d_2$ and $c_2\ m_3\ d_3$ be true arcs of circles, although they may represent such arcs. The only points which are correct in these arcs are the points $c_2$, $m_2$, $d_2$, and $c$, $m$, $d$, also $c_3$, $m_3$, $d_3$, and intermediate points will not lie in arcs of circles, but for all practical purposes we may assume, as we have done, that all the intermediate points will lie in arcs of circles. On account of these inaccuracies in the curves, the ellipse $c_2\ t_3\ w_2\ t_4$, when drawn, may not be exactly tangent to the curves $c_2\ m_2\ d_2$ and $c_2\ m_3\ d_3$, but the inaccuracy will be so slight that the arcs can easily be adjusted so that they will be tangent to each other, as they should be.

396.—From the foregoing remarks the reader must not conclude that we advocate "a near enough policy," as good enough in practical drawing. Absolute accuracy should always be maintained; but there are cases, and the curved lines in these nuts are some of them, where a slight inaccuracy is admissable, because the great amount of labor that would be required to draw these curves accurately would in nowise help the workman in reading the drawing, neither will the amount of labor be adequate to the benefit derived.

There may cases arise in which the curves $c\ m\ d$ and $d\ t\ e$, etc., must be accurately determined. How to do this will be explained when we take up the subject of the intersections of solids.

*Directions.*—In the space marked Prob. 54 draw the vertical and horizontal projections of hexagon collar nut suitable for a bolt $\frac{7}{8}$ inch in diameter. The depth of the hexagonal part is to be $\frac{7}{8}$ inch, the diameter of the collar is to be equal to the distance across corners, and the depth of the collar $\frac{3}{8}$ of an inch; the axis of the bolt is to make an angle of 60 degrees with the horizontal plane of projection, and is to be parallel to the vertical plane of projection. Draw the projections full size.

*Problem* 55.

PRACTICAL APPLICATION OF SOME OF THE FOREGOING PROBLEMS.

397. IT IS REQUIRED TO MAKE A WORKING DRAWING OF A BOX OR BEARING SUCH AS IS SHOWN IN FIGS. 281 AND 282.

Fig. 281 represents a cast-iron box or bearing for a shaft. This bearing does not belong to any particular machine, neither is it given for the purpose of showing the proportions of such a box, although we believe it to be correct in design. The purpose for which this box has been designed and drawn was to furnish the student a suitable and interesting object whose vertical and horizontal projections embody some of the principles given in previous problems; and if these have been thoroughly understood, and since no new principles are introduced, the student should not have any difficulty in making this working drawing

For the sake of simplicity, we have left out the Babbitt metal in the bearing, or brasses, as circumstances may require.

Again, since the principles connected with the manner of finding the projections of this box have already been thoroughly explained, we deem it unnecessary to enter into a minute explanation, but will simply give a few hints and reminders.

In making this working drawing we must commence with the vertical projection, or elevation of the box, because we can draw this view without any reference to any other projection. In commencing this projection, and in fact all projections, we must commence by drawing the center lines, hence in this case we draw the horizontal center line $s\ t$, the vertical center line $C\ B$, and the oblique center line through the center $C$. After this we may proceed by drawing the line $F\ G$ and working upwards, or we may proceed by drawing circles from the center $C$, and then drawing the other lines at the right and left, and working downwards.

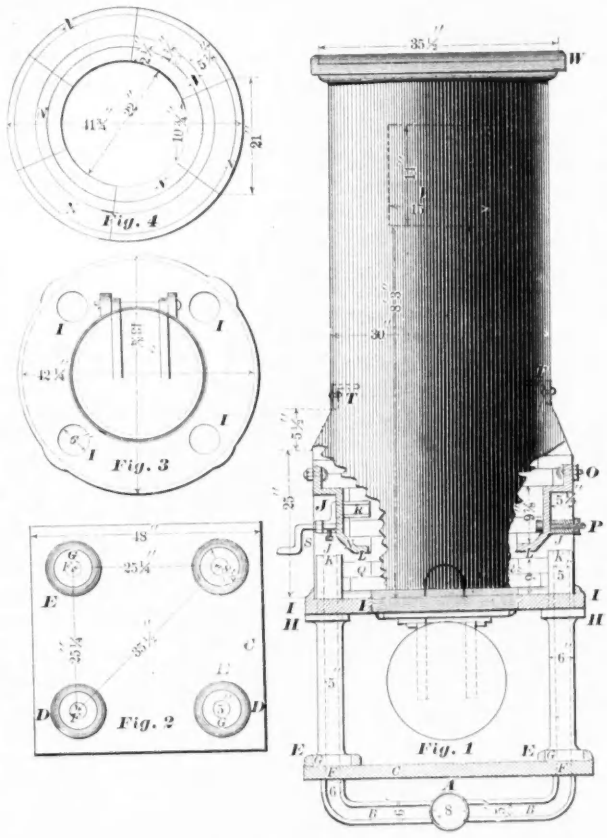
The boundary lines of the ends $j$ and $j_3$ of the cap are semi-circles, and, since this cap is in an oblique position, each one of these ends in the horizontal projection (Fig. 282) will be represented by a semi-ellipse, and consequently in Fig. 282, the true forms of the ends cannot be seen, and therefore a separate view of the ends of the caps such as shown in Fig. 283 is necessary. In this view the cap is supposed to be parallel to the vertical plane of projection, and therefore the true form of the ends of the cap will be seen.

The method for finding the horizontal projections $u_2\ v_2$ of the nuts is precisely similar to that employed for finding the horizontal projection of the nut in Problem 54; also the method for finding the horizontal projections of the ends of the caps such as $x_2\ j_2\ y_2$ is similar to that employed in finding the horizontal projection of the collar on the nut in Fig. 279, or finding the horizontal projection of the bases of a right cylinder in Fig. 268. All the curves drawn through the points $j_2\ i_2\ h_2$ should be alike, that is, they should be semi-ellipses, but the curve through $k_2$ should be a semi-circle. The horizontal lines through the points $x_2\ y_2$ should connect with curved lines lying to the left of the semi-circle through $k_2$, but since the student is not supposed to know at present how to find these lines, they have been omitted.

It should also be remembered that the center $C$, and the center line $B_2$ in Fig. 282, must lie in the same vertical line. Also, since the point $f_2$ and the line $f_3\ f_4$ represent the same edge, they must lie in one vertical line (Art. 238). The same remarks apply to any point and line which represent one and the same corner or edge of any object. The dimensions given in the illustrations are not merely given for the purpose of guiding the student in making the drawing, but they are also given for the purpose of showing how the dimensions should be written on a working drawing.

Full sized drawings, or those drawn to any scale, are not complete, and have no value in a workshop unless all the dimensions are written plainly upon them. Drawings without the dimensions written upon them should not be tolerated in any shop.

*Directions.* In the space marked Prob. 55 draw the two views of the bearing according to the dimensions given. Use a scale of 6 inches to the foot; that is, make the drawing half size. Write all the dimensions on the drawing as neatly as possible.




A FOUNDRY CUPOLA.

## A New Electric Tram Car.

A trial of a new electric tram car was made on the 15th December upon the Willenhall line of the Wolverhampton Tramway Company. The car was built at Shrewsbury, for Messrs. Elwell-Parker, Wolverhampton, who are fitting it up with electrical appliances for the Australasian Electric Tramway Company. Should this car give satisfaction, the system embodied will in all probability be generally adopted for their service. This company have been watching the working of electrical cars in America and on the Continent, where a similar system has been in use for some time; and the engineer of the company, having witnessed the successful work of tram cars fitted with Messrs. Elwell-Parker's motors in Brussels, was induced to entrust the work to this firm, as they have been largely engaged in electric tram car work at Portrush, Blackpool, and other places. In the latter systems the current has been supplied to conductors laid alongside or below the track, from which it has been derived by brushes and similar appliances and conducted to the motor carried by the car. A different system has been adopted in the present case, in which secondary batteries are employed. The batteries are, by a simple operation, run in under the seats of the car, and can be readily replaced by recharged cells. The accumulators are capable of working the car for seven hours, under ordinary running conditions. The motor is geared direct to the axles, and runs at the low speed of three hundred revolutions per minute. Switches are arranged at each end, so as to be directly under the control of the driver. During the trial, the car traveled at the rate of fifteen miles per hour on the level, and ascended an incline of 1 in 15 without difficulty. We hope shortly to give an illustrated description of this system.—*Industries.*

## Master Car Builders' Association.

Following is the list of subjects upon which committees are appointed to report at the next meeting of the Master Car Builders' Association:

1, Standards and Appliances for the Safety of Trainmen; 2, Automatic Freight-Car Brakes; 3, The Best Form and Construction of Car Roofs; 4, Car Heating; 5, Wheels; 6, Journal Lubrication, and the Best Practice for Economizing Oil; 7, The Best Form of Door Hangings, including Grain Doors; 8, How Can Uniformity in the Interchangeable Parts of Cars be Obtained; 9, Committee of Arbitration in Disputed Cases under the Rules of Interchange; 10, Subjects to be Reported at the Next Annual Convention for Investigation and Discussion at the Succeeding Convention; 11, Committee of Arrangements for the Next Annual Convention.

The *Nautical Gazette* has this tribute to the life of Pilot John Maginn; who could ask better?

The brave old pilot, after a pilgrimage of 80 years, has been signaled to go aloft. Never more will his sonorous voice be heard nor his cheery face be seen on earth. Sixty years he spent in active pursuits, and though a ready fighter, he was always on the right side. He had his peculiarities and mannerisms, his affectation of gruffness being really the thinnest kind of covering to prevent the masses peering too deeply into the warmest and most sympathetic heart that ever pulsed with life.

## A Foundry Cupola.

BY ROBERT E. MASTERS.

This cupola, designed by G. D. Harris, for use in the new foundry of the R. and A. R. R. shops, is now in active operation and gives good results.

After the main blast pipe $A$, Fig. 1, and four branch pipes $B$, $B$ were laid in the foundation, the base plate $C$, which is a section of Fig. 2 from $D$, $D$, was put down; this plate has a circular rib at each corner $E$, $E$, with a 5″ hole at $F$, $F$. The plain flange end of the hollow posts at $G$ set over this hole and within the flange. These posts have a flange at $H$ for the bottom plate $I$ to rest on, and they extend through the plate into the air box $J$. Thus it will be noticed, the blast is carried by the four branch pipes through the legs of the cupola into the air box, and the open end of them at $K$ is far enough above the continuous tuyere $L$ to prevent any iron getting into them.

Fig. 3 is the bottom plate and door looking underneath the cupola. (I expect some of our highly educated readers will think I ought to have said "an inverted plan," but I want to say now, in this and every article I write in the future, I shall (as in the past) use plain shop language, so that any of our foundry friends who wish to make use of appliances represented can do so without being confused by something they do not understand.)

The tuyere opening $L$ and air box $J$, Fig. 1, are formed by bolting segments $N$ $N$ to the cupola at $O$ and $P$. At $P$ the bolt is put through a piece of gas pipe between the cupola shell and tuyere segment, to hold them the right distance apart. The brick lining

*Q Q* comes within about 1″ of the bottom of the segments.

Fig. 4 is a view of the segments after they are put together, looking down through the charging door before lining up. *R*, Fig. 1, is an extra set of tuyeres. There are three of these, $1\frac{3}{4}$″ diameter, placed at equal spaces above the lower tuyeres, and they can be shut off or opened at will by cranks *S*. The dotted lines *T T* is an angle iron, bolted to the inside of the shell to support the brick above it when relining the lower part of the cupola. At *V* is given the size of the charging door.

*W* is a square cast-iron plate with a circular flange on the bottom side to fit; outside the cupola shell there is also a flange on the upper edge. The upper part of the stack is of brick and is built on this plate, which has a hole in it a little larger in diameter than what the cupola is lined up to. The writer had all the castings made for this cupola, and only such figures as are not given in the drawing will be contained in the following table, which was kindly furnished by Nicholas Ferriter, foreman of foundry:

DIMENSIONS.

| | |
|---|---|
| Thickness of lining | 4 inches. |
| Largest melting point or inside diameter | 23 inches. |
| Length of main blast pipe | 83 feet. |

MODE OF CHARGING CUPOLA.

| | |
|---|---|
| Fuel used for bed | Coke, 200 lbs. |
| 1st charge of iron | Scrap, 1,000 lbs. |
| 1st charge of fuel | Coke, 40 lbs. |
| 2d charge of iron | Scrap, 500 lbs. |
| 2d charge of fuel | Coke, 40 lbs. |
| 3d charge of iron | Scrap, 500 lbs. |
| 3d charge of fuel | Coke, 40 lbs. |
| 4th charge of iron | Scrap, 500 lbs. |
| 4th charge of fuel | Coke, 40 lbs. |
| 5th charge of iron | Scrap, 500 lbs. |

MODE OF WORKING CUPOLA.

| | |
|---|---|
| Time of starting fire | 12 noon. |
| Time of charging first iron | 1.30 P. M. |
| Blast put on | 2.00 " |
| First appearance of fluid iron | 2.07 " |
| First stopped in | 2.10 " |
| Bottom dropped | 3.07 " |
| Revolutions of blower, 2,400. | |

TOTALS.

| | |
|---|---|
| Amount of iron melted | 3,000 pounds. |
| Amount of fuel consumed | 360 " |
| Ratio of fuel to iron used | 1 to $8\frac{1}{3}$ " |

Mr. Ferriter says the above heat is stated with exactness, and that the upper tuyeres were kept closed. It will be noticed that all scrap iron was used in the heat which was medium light.

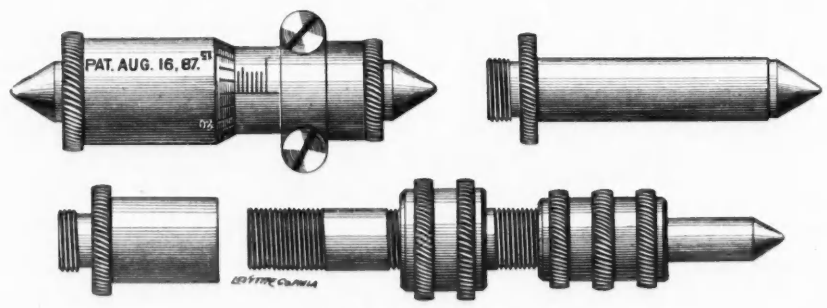
## Inside Micrometer Caliper.

The caliper which we illustrate herewith does not measure and indicate actual sizes by inches and parts of an inch, only to a certain extent, the limit of which will be explained hereafter; but it does indicate the exact inside space of any distance between two walls or sides of either round or flat surfaces, within the limit of its adjustment, and is designed to be used as, and to take the place of, the usual inside leg caliper. As all parts are rigid, and as there is no lost motion of any kind whatever, there can be no spring; and as the calipering points of contact are always in a straight line, no matter what the size of hole or space is to be calipered, they present a handy surface to take the size from, and the micrometer feature of it enables the operator to transfer the exact size to the outside or other caliper that is to be used to transfer the size from one to the other. It is recommended for use by persons having shrink or forcing fits to make, like car-wheel axles, crank-pins, piston-rods, etc., as by the micrometer feature of it any allowance can be made to the one-four-thousandth of an inch; and the same features are apparent in making loose or working fits, as the exact size of hole or space, as well as any variations, can be very readily found, thereby determining the smallest size, and making the work to correspond without having any "cut and try" to do. As the "feel" of the caliper must be the same in all cases, to as fine a measurement as the one-two-thousandth of an inch, owing to the absence of all spring in the tool, the caliper should determine the exact size, no matter by whom used. All the contact points of the caliper are hardened, to preserve from wear as much as possible.

The following explanation of the mode of using the tool is appended: To understand the micrometer feature of the caliper let it be understood that the standard inch is divided into 40 parts by the micrometer screw, hence each of these 40 parts is equal to $\frac{1}{40}$th of an inch. Then, by the use of the micrometer sleeve, each one of these 40 parts is divided again into 25 parts; hence each one of these parts is equal to $\frac{1}{1000}$ of an inch, for $25 \times 40 = 1{,}000$, and $\frac{1}{2000}$ or $\frac{1}{4000}$ is very readily obtained by simply dividing the spaces on the micrometer sleeve into two or four equal parts, respectively. In the outer end of the micrometer screw is inserted one of the hardened steel contact points. The outer milled end of the micrometer screw also forms the "grip," by which it and the micrometer sleeve are revolved in and over the correspondingly threaded split nut or tube, which is provided with two small screws to take up any lost motion produced by wear of the two parts revolving in use. In the end nearest the "take-up" screws is inserted one of the removable hardened steel contact points, and between the removable point and the take-up screws will be found a reinforcing ferrule.

By closing it to its shortest length it will caliper a hole or space $2\frac{5}{16}$ inches diameter or width; and by extending it to the full capacity intended in the designing ($\frac{3}{4}$ of an inch), it will caliper $3\frac{1}{16}$ inches, and any size between. By removing the removable contact point, screwing it into the socket (shown in illustration directly under the micrometer head), and attaching both combined to micrometer head, it will caliper a hole or space from $3\frac{1}{16}$ inches to $3\frac{1}{8}$ inches, inclusive. The long removable point (shown in illustration on the line with micrometer head) is to be used in the same way as the short one. The smallest hole or space it will caliper is $3\frac{1}{8}$ inches, and the largest, without the use of socket, $4\frac{7}{16}$ inches, and with the socket, from $4\frac{7}{16}$ inches to $5\frac{3}{16}$ inches, inclusive.

By removing the long removable point from socket and screwing in the combination removable point (shown in illustration on line with socket), the calipering capacity is further increased. The combination point is composed of a piece of brass tubing, having a slotted brass holder attached that has a reamed hole, in which the extension rod fits snugly; one end of the holder has the nut mechanism for holding the adjustable rod, the other end forming the grip to hold on by while tightening the nut, and also to screw it into the socket. On the inner end of the adjustable rod will be found a mark to act as a gauge. By the use of the combination point an extension both ways, by the adjustable pointed rod, and also by the micrometer head, is obtained.




INSIDE MICROMETER CALIPER.

It can be used as a standard gauge only to the extent of the extension of the micrometer head ($\frac{3}{4}$ of an inch) in this way. By adjusting it to a standard gauge of known size, and noting the graduation mark on the sleeve that corresponds with the indicating mark on the split tube, then, as before stated, a certain number of full turns or parts of turns indicate a certain fraction of an inch; as, for instance, 5 full turns from a given mark on graduated sleeve will equal $\frac{1}{8}$ inch; $2\frac{1}{2}$ turns, $\frac{1}{16}$ inch; $1\frac{1}{4}$ turns, or $\frac{31\frac{1}{4}}{1000}$, will equal $\frac{1}{32}$ inch; $\frac{15\frac{5}{8}}{1000}$ will equal $\frac{1}{64}$ inch, etc. These calipers are at present being made in four sizes, viz.: No. 1, with capacity from $1\frac{1}{2}$ inches to 3 inches; No. 2, capacity $2\frac{5}{16}$ inches to 8 inches; No. 3, capacity from $2\frac{5}{16}$ inches to $13\frac{1}{4}$ inches; No. 4, $2\frac{5}{16}$ to $23\frac{3}{4}$ inches.

The manufacturer is David Brown, 1531 South Fourth street, Philadelphia, Pa.

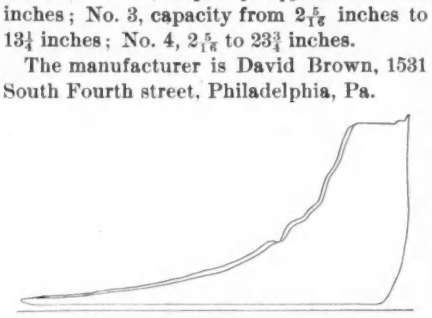


DIAGRAM FROM CYLINDER.

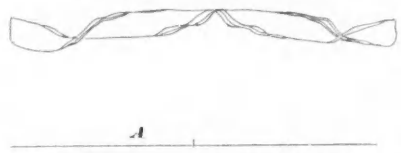


DIAGRAM FROM STEAM CHEST.

## LETTERS FROM PRACTICAL MEN.

### Steam Pipe Pressure—A Protest.

*Editor American Machinist:*

I get a great deal of satisfaction from the letters from practical men in your journal, and will try to give a little of my own practice in an engine case. A 14″ × 42″ Corliss engine, when indicated, showed a falling off of pressure in the cylinder of from ten to twenty pounds, according to the load, below boiler pressure, as indicated by the steam gauge. Steam was carried to the engine through 50 feet of 4″ pipe, which was supposed to be amply large to supply the cylinder at very nearly boiler pressure. But the difference between cylinder pressure and boiler pressure led to the testing of both the steam gauge and the indicator spring. The steam gauge was tested by comparison with several others in town, and found to agree with all, and was called correct. Then the engineer and myself began the testing of the indicator spring. A careful examination of the indicator showed that the piston did not travel true in the cylinder, and possibly bound a little at the upper end; but to find out how much was the question. It was attached to the boiler and steam turned on, and the cord pulled by hand. The experiment was repeated several times, and the steam line did not vary more than one pound from the pressure indicated by the steam gauge. Not quite satisfied, the indicator was attached to the water main and pressure turned on. The pencil flew up to two pounds above pressure indicated by gauge, and remained there until touched by the finger, when it fell to the point indicated by gauge and remained stationary as before. The pencil could be easily moved over a space representing two pounds pressure, and would remain anywhere within that limit. So it was concluded that the spring was correct within two pounds, but that did not account for the loss of twenty pounds pressure in the cylinder; and there was another point that it did not account for, which was the fact that the loss of pressure was inversely as the load on the engine; that is, the lighter the load the greater the loss of pressure. With a full load the loss was only ten pounds, while with about half a load the loss was fully twenty pounds, and in one instance reached twenty-five pounds. The engine was indicated, and the enclosed card from the crank end was the result. Perhaps the steam pipe was too small. We would see. The steam pipe was indicated near the boiler and full pressure recorded by the pencil. It was then indicated as near the engine cylinder as it was possible to tap a hole. The result was one of Chas. T. Porter's steam-chest diagrams, which I also enclose. It shows the pulsations of the steam between the boiler and the engine, and shows also that so light a material as steam possesses considerable momentum as well as elasticity. The diagram shows that the steam pipe is too small for its length, and also, I think, shows why the cylinder pressure decreased with the load.

There is one other thing on my mind. Every little while some one writes an article for the AMERICAN MACHINIST describing some arrangement of steam pipes, or a more economical method of doing a certain class of work that is new to ninety-nine per cent. of your readers. But the hundredth man, almost bursting with superior knowledge, at once sits down and indites a letter, saying, "That is not new; I used that in my practice twenty years ago"—or something of that sort. I do not like the spirit that causes it. Whenever I read from the pen of some mechanic, away off in Mexico, a description of something that just tallies with my own experience in Wisconsin, I want to shake hands with him and talk the matter over and find out if he don't know something that is as new to me as what he has written is to most of your readers.

In my mechanical experience I have discovered numberless old things and have originated methods that I afterward found out were as old as the trade itself. The credit is due to the man who makes his discovery public, whether he is the first one or not. When Robert Masters made public the fact that "agricultural" steel scrap could be profitably melted in an ordinary foundry cupola, he told something new to almost everybody, but there were those who tried to take away the credit that belonged to him. In a small way I have been spared the mortification (?) of telling some "chestnut" to the boys, more than once. Not long ago I satisfied myself that the proper place for the steam drum, supplying any automatic engine, was just as near the cylinder of said engine as it was possible to put it. Speaking about it, one day, to a friend, he handed me a catalogue of a steam engine builder, with advice to that effect. Had I written to the AMERICAN MACHINIST, I should probably have seen that such had been the usual practice of a certain engine builder, for years, to recommend a steam reservoir.

Springfield, Vt. F. L. JOHNSON.

### Covering for Steam Cylinders and Pipes.

*Editor American Machinist:*

I suppose there are few who do not acknowledge the value of covering steam pipes with some good non-conducting material, and I believe that no well-posted steam user will be satisfied with his coal bills, until such pipes are properly protected. But, as an engineer, I want to say that engine builders don't seem to appreciate such material. I saw an elegant steam plant the other day; everything first class except "lagging." True, the cylinder was covered on the sides extending to steam chest. As I saw the steam pipe covered I thought of its resemblance to a man with an overcoat on, gloves and hat, and barefooted. The cylinder heads and the steam chest (extending almost the length of the cylinder) were not covered. Well, this is, with single cylinder engines, almost the universal practice. Perhaps to some extent it may account for falling pressure before cut-off. But at least it must be a loss.

It would not require a great amount of ingenuity to construct effective coverings for the heads, such as could be quickly detached if necessary, light, and at comparatively low cost. The cost would not exceed turning up a fancy ornamental head. Front head laggings could come out flush with gland. The steam chest lagging, of course, would have to conform to the various openings in it. I believe these coverings are of practical value, and there is certainly no reason why, in this day of close scrutiny of

the coal bills, engine builders should not "catch on."

Then there is the boiler feed pump. Who ever saw one lagged, save with paint? I saw a fine pump the other day, duplex, well proportioned, to supply boilers of 350 horse-power. The steam pipe was covered to throttle and there it stopped. As some one said, "You could scald hogs at the exhaust." There may be, in the inscrutable wisdom of the steam pump men, some unknown reason why they can't put some asbestos and Russia iron on a steam cylinder, and try to save steam. Perhaps the last is something they never thought of in connection with a boiler feed pump, and may account for the growing trade in injectors.

But I thoroughly favor the covering of the cylinder, both heads and steam chest, and believe the builder of engines and pumps would find such improvements appreciated.

Springfield, O. T. T. PARKER.

## Pulleys and How to Make Them.

BY S. BOLLAND.

SECOND PAPER.

At Fig. 11 I have shown a method of making pulleys from patterns which have the arms either cast with or secured to the rim. The lifting plates in this case are used separate, and must be made with a sharp edge to fit against the rim, in order to insure a good lift, as seen at *A*. The lifting irons must be long enough to stand through the bars of cope, as at *B*, and the best way of connecting them with the plates is to have the hole in the plate a little smaller than the iron, so that a shoulder can be forged on, to prevent them slipping through. In riveting the button underneath, leave it slack, so that the iron can be turned easily in the hole. This allows of its being twisted round to clear the bars in the cope. Pulleys can be made very readily from these patterns when the flasks and lifting plates are in good order. The handiest way of working them is to ram the inside first, make parting at arms, and bed down the plates, after which ram up to the top in the inside, and loosen the pattern all around before the outside is rammed. After the cope is rammed the plates can be quickly secured to the cope by wedging under the irons put through the eyes of the lifting irons. The figure shows an iron flask with long pins, but if wood flasks are used, a little extra care in fitting on good slides will be necessary.

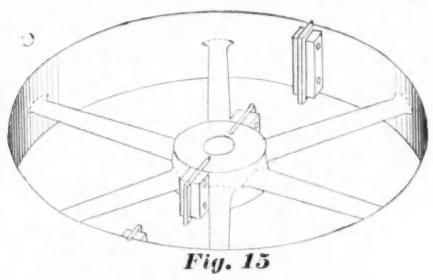


*Fig. 15*

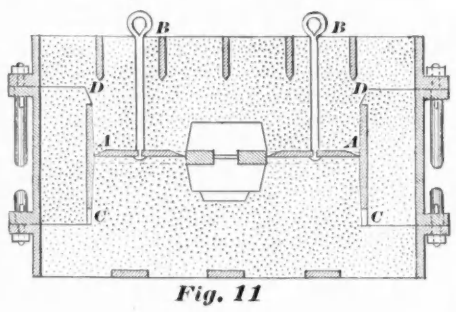



*Fig. 11*

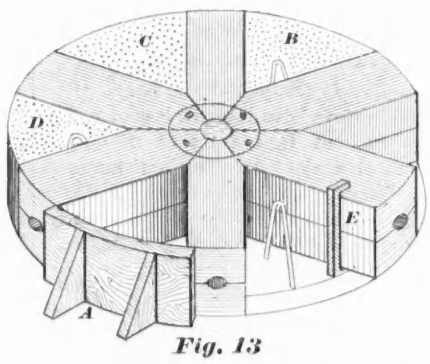



*Fig. 13*

The pattern shown in the flask is 30 inches diameter and 8 inches deep, but the casting required is to be 12 inches deep. Now, as this is not a loose rim, another method must be adopted to deepen the rim and have the arms in the center when cast. In order to do this one-half of the difference must be added to the bottom and the other to the top. The way to do this is shown in the figure. The pattern has been drawn two inches from the bottom at *C*, and the outside parting is made two inches above the pattern at *D*, where a little draught has been given to the joint to save dragging up the parting. When the cope has been lifted off the pattern must be placed on the top part of mould and a strickle passed round under the edge to scrape out the sand level with the inside. This will insure a perfectly even thickness all around, which could hardly be the case if the pattern was not used for a guide, as directed. If the flasks for this class of work are made after the manner shown in this figure it becomes an easy matter to part the mould at the bottom, and this enables the moulder to finish his work satisfactorily.

Pulley patterns which are standard and not more than 2 feet diameter, nor any deeper than 6 inches, are best made as shown at Figs. 3 and 4. I prefer the one at Fig. 3, for the reason that both halves are equally strong and less apt to get broken. Another advantage is that there is less trouble in parting the arms. If good headway is to be made with this class of pulleys, light iron flasks are indispensable.

PULLEY MOULDING FROM SWEEPS AND CORES.

Sometimes a pulley is ordered for which there is no pattern. When this occurs a very simple plan can be adopted to overcome the difficulty.

Let us suppose the pulley to be of the same dimensions as the one shown at Fig. 5, 6 feet diameter, 12 inches deep. Figs. 12, 13 and 14 will show the different stages of such a job with very little explanation.

After a suitable hole has been dug in the floor in which to mould the pulley, set in two straight-edges and strike off a true bed, in the center of which ram up a good stout steady pin, after the manner shown at *A*, Fig. 12 (It is supposed there is no spindle or center where this pulley is being made.) A plate *B* is now bedded down one inch below the surface, as at *C*, and the joint continued to the surface of mould as at *D*. Although this plate is shown well up to the center, it really does not require to come any further than the point where the cores meet each other in the hub, thereby saving weight. The surface over the plate is now to be swept off level with the outside and a line struck to the inside diameter of rim, to be divided into six, and each division to be drawn to the center. Fig. 13 shows the cores made in halves joined together and set into position; it will be observed that these cores, when together, are the exact depth of the rim. All that is required now is to set sweep *A*, Fig. 13, and ram in between the cores; spaces *B*, *C* and *D* are shown as filled in and the sweep moved round to the next space. Before proceeding to ram in the spaces the cores can be clamped together as seen at *E*, Fig. 13, as many being used as are thought requisite; observe that provision is made for running in the hub, and that the end of cores form print for center core. After this operation is complete hitch on to the handles shown, and lift the whole thing out of the mould, taking care to steady it out of the feet shown at *E*, Fig. 12.

Just here I will explain why I lift out the inside. It is customary, in making pulleys from cores and sweeps, to have segment cores to make up the outside, setting them to line and ramming behind them after they are all in position; but I have yet to see the casting made after this manner that was true, or anything near it; therefore, I think that the little extra labor entailed in lifting out the inside is more than compensated for if we gain a correct outside by the operation.

Fig. 14 is a view of the bed under the plate with parting all round and the bottom surface on which the sweep rests. This sweep is the one used for the inside, with the braces reversed and continued to the center pin, which it is supposed to fit accurately. The view shows the sweep as having been started at *A* and the upper side rammed as far as *B*. I have shown the center pin as standing up above the bed on which the lifting plate rested. It will be seen that in attaching the continuation of the braces, they are shouldered together at *C*; this allows of their easy separation before the sweep is removed if it should be thought desirable to do so; if the pulley was round on the face then it would be requisite to do so. To make a flange pulley by this method have a segment or flange for top and bottom, bed in the top as you go along, the bottom one to be set against the sweep and withdrawn each move that is made.

When the outside is rammed and finished it will take but a short time to complete the job. After the center has been taken out and the hole made good, place back the inside and cover the rim with cores, as shown at *F*, Fig. 12. The center core is seen in place at *G*, Fig. 12, but it must be remembered that the plug *A* is supposed to be out when the plate goes back, otherwise this figure may be taken as a sectional elevation of the mould when closed, cut through the center of arm core on one side and through the space on the other, exposing handle *H*.

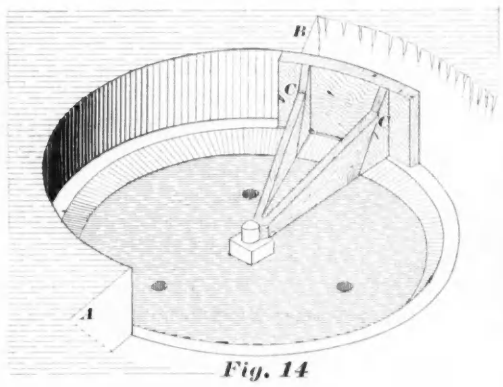



*Fig. 14*

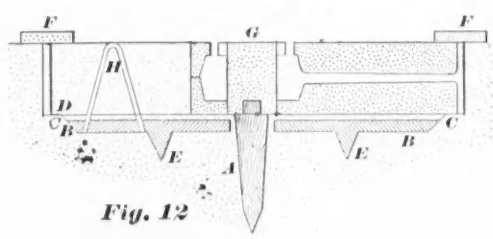



*Fig. 12*

PULLEYS AND HOW TO MAKE THEM.

TO SPLIT A PULLEY.

This is generally considered an unpleasant thing to do, but I think that a considerable amount of the annoyance is self-inflicted. Ordinarily too little care is taken in the preparation needed to insure success in splitting a pulley or wheel. Some of the methods adhered to have been handed down to us by our grandfathers, and we stupidly insist on their use, good or bad. Very often it occurs that a split pulley is wanted in a hurry and along with the pattern comes the splitting plates cut out of plate iron perhaps not more than $\frac{1}{16}$ inch thick. Suppose the pulley to be six feet diameter, 12 inches deep, with a very heavy hub, such as shown at Fig. 15 (which is a sketch of the inside of pattern with splitting lugs attached) In some foundries all that is considered necessary is to heat the plates and paint them with gas tar, but it invariably happens that when there is a considerable body of metal that the tar burns away, and the plates are fast in places on both sides, making it difficult to separate the halves; in fact, it is no uncommon occurrence to break the casting somewhere else in the effort used to split it. Such a method as this ought to be abandoned at once. Again at other places the splitting plates are treated to a thin coat of fine loam, and if the loam could be kept on them the plan would not be without some merit. But when spikes are thrust down each side to secure them, it is barely possible to keep them in good trim. However much success may attend the use of plates prepared this way, they cannot in any case be used for packing when the pulley is bolted together, being slack the amount of loam used to cover them. Some think oil will do, and others maintain that a coat of blacking will answer the purpose, but I need not waste words to prove the inadequacy of such methods to insure a good job.

As before stated, Fig. 15 shows the inside of a pulley pattern with the splitting lugs attached. The prints seen on the lugs are to receive the splitting plates. Let patterns be made for these plates $\frac{3}{8}$" thick, with front edge feathered. The feather edge must set into the rim a little, and as far back from the center core as will permit of an easy split.

In moulding these plates use such sand as will allow the hot iron to eat into it, so that the skin of the metal will not be exposed; when cast, rub off the loose sand and spread a coat of very thin glue all over the surface, over which a little fine burnt sand can be dusted. When dried the surface will be very hard. A thin coat of black lead, made with glue water, can now be brushed over them and again dried. They are now ready for use, and will stand any amount of handling. This method insures a clean split every time, and no trouble from blow-holes, from the fact that the material with which they are covered emits little if any gas when the molten iron comes against it.

## PERSONAL.

Charles Davis, of the firm of Lodge, Davis & Co., Cincinnati, Ohio, favored us with a call recently. Mr. Davis reports business prospects at Cincinnati as being very promising. This firm has pushed sales eastward during the past year, their recent sales of machine tools in New York being large.

A standard item of advice, given by the press at regular intervals, is "Never carry your business home." There is about as much nonsense about this as there is about the regular standard article of advice on any subject given by the Oracle. Men may and do carry the worry of their business home with them to an extent that injures their health, and eventually breaks them down. On the contrary, men, in the quiet of home, do a reasonable amount of thinking in regard to their business, to much better purpose than they can do it in the busy hours of the day, and with much less wear and tear to themselves. In the trades, the boy who never thinks of his work except in the shop gets left behind by those who do, and he is no more likely to live to an old age either. There should be moderation in all things; it is the immoderate, not the moderate use of one's time that works injury. The old saw that would prohibit thinking about what one is doing, except by the clock, is at fault.

A returned tourist said recently: "So Charles Dickens doesn't like the way we heat our railway cars. We really must adopt the English way. And what is that? Why, a rather large flattened tomato can is filled with hot water and put on the floor of the carriage, and you're supposed to keep warm on it. The only way to get any warmth out of it at all is to hold it on your lap, and then your back freezes. One of these hot water cans is expected to keep you warm for twelve hours, It gets stone cold within two, and ice cream may be kept from melting on it."—*Buffalo Courier*.

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☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

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NEW YORK, JANUARY 28, 1888.

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## Arbitration in Industrial Disputes.

There are some industries in which, for the public good, the principle of arbitration ought to prevail. One of these is that of coal mining. A long strike in a coal district is likely—almost certain—to result in great hardship and suffering in cities supplied from that district, by increasing the price of coal to those who can scarcely afford to pay the lower price. And such a strike is likely to bring about cessation of work in manufactories, throwing workmen out of employment, and disarranging business generally. Not only the business of the country, but the life of the people depend upon the coal supply, and private purposes must sometimes give way to public exigencies. The public has a right to demand—the territorial limit of coal being comparatively small and coal being an absolute necessity to life—that the supply shall not be stopped, nor interfered with unnecessarily, to the loss and danger of the people.

The argument is frequently put forth by one side or the other to a labor dispute, that in certain cases arbitration cannot prevail, because there is nothing to arbitrate. This argument is weak, and if allowed to stand will effectually prevent arbitration. There may be certain points in dispute that are not proper subjects for arbitration, but those called upon to settle the dispute are the proper persons to decide this. If suitable persons are selected, they may be depended upon to throw out all irrelevant issues, to the prejudice of those raising them. If either party is permitted to decide certain points for themselves, then so much of the case is decided by *ex parte* judgment, and the points the disputants would be likely to want to settle in this way, would soon come to cover the entire case.

We are hardly prepared to believe that arbitration will become universal in labor disputes, but when the case in dispute involves the business of a large section of the country, not only deranging the business, but endangering the lives of those in no way interested in the dispute, it is time to inquire if, in the interest of protection to life and property, something cannot be done to provide for a peaceable settlement.

## Securing Manufacture.

In these times exertions must be made to secure the location of manufacturers in new towns and cities. This is because it is, so to speak, the fashion to put forth efforts to this end. It is something like the business of the drummer in the modern way of selling goods. Probably about as many goods would be sold if there were no drummers, but the assumption is that the sales would not be so evenly distributed. This may or may not be true, but it is reasonably certain that if a few houses were to try to get along without personal solicitation they would suffer in comparison with those who employed men to travel, and represent their goods. So in these times the new town that does not contrive to let it be known that it will welcome manufacturers is likely to lose ground in this respect.

Sometimes the efforts that are put forth to the end of inducing manufacturers to locate are hardly such as would be dictated by a strict sense of justice. As for example a rebate of taxes when there is already in the same place manufacturers in the same line paying their taxes regularly. Generally, however, the inducements offered do not work serious harm to any of the inhabitants, but on the contrary the location of manufactories brings citizens with it, and makes the payment of taxes easier to all, besides increasing the value of property.

While a few years ago these extra inducements to manufacturers were only offered by towns just building up, competition in this has induced comparatively old towns and cities to enter the race, so that a manufacturer expects some kind of a bonus as an inducement to locate, in nearly every part of the country. We doubt if this is, on the whole, advantageous to any parties concerned if we take the country as a whole, but it is fashion that has evidently come to stay, and a town without its board of trade, or something of a similar character, working to create new industries, is likely to be as badly off as the manufacturer who does not bring the knowledge of what he makes before the public.

## Cheap Water Supply.

The past fall and early winter have been full of lessons to hundreds of villages in this country that are not adequately supplied with water. Wells have gone dry, the water from wells has become polluted, and sickness and suffering have resulted. In the aggregate the loss in dollars and cents has been enormous. And yet if the money for water-works is judiciously expended the water tax will in nearly every instance, be so small as scarcely to be felt. In this direction some figures given by Stephen Harding Terry, of England, are of interest, showing as they do how small the tax for water may be, even when only a few people are to be supplied. Mr. Terry, who has had exceptional opportunities for observation, instances villages supplied by different methods. In one instance the cost, for gravity system, to a village of 678 inhabitants, which cost provided for the extinguishment of the debt in thirty years, was scarcely more than three cents per week for each house.

Another case is one in which the supply, for 180 cottages, is by pumping. The reservoir holds a supply for four days, so it is only necessary to run the pump twice in the week. The cost for the 180 cottages is six cents each per week, this leaving a balance of sixty odd dollars per year for repairs, after providing for canceling the indebtedness in thirty years.

The bugbear of cost often prevents the inhabitants of towns and villages from having a good water supply. Sometimes money has been most injudiciously expended for this purpose, but this is generally the result of ignorance. The village Solon is not generally the man to plan water-works, only a man skilled in such matters should be employed to look over the necessities and the facilities, and to prepare plans and estimates. If this is done the expense will be kept low, and the fact that the village cannot afford to be without water supply will be demonstrated.

It has always been more or less of a puzzle to account for the reason of certain mechanical devices working satisfactorily in one locality and not in another. There is a variety of packing for steam engines, for example, and in one part of the country one kind will be found in common use, giving excellent satisfaction, while in another place, the same kind of packing will not seem to work at all. The reason is probably almost entirely one of education, not necessarily perhaps in the use of packing, but in analogous directions. In some parts of the country a certain class of machinery will be sold, and will be used with the best satisfaction. In other localities, this same kind of machinery cannot be sold, or, if sold, its use will not give satisfaction. This is generally laid to prejudice, but it is more likely that education has much more to do with it. Shrewd salesmen understand this, and they understand that it is practically useless to undertake the slow process of educating people to buy what they have not already learned to like and use. They find it more profitable to sell what there is a demand for, letting the demand for something else grow up by the usual slow process.

## Literary Notes.

The *Mechanical Engineer* has ceased to exist, in name, and in its place we find *The Engineer*. The "overcoat" has been discarded, which is so far all the change we note.

The Denver *Journal of Commerce* does itself proud in its holiday issue. It shows up the attractions of Denver in a way that ought to be locally appreciated. We hope it will be repaid about a dozen times for the enterprise it shows.

The *Northwestern Miller* has surpassed itself in its holiday number for this year. Pictorially and typographically it is in the front seat. We have not counted the pages, but they are numerous and artistically illuminated in various colors. We wish our contemporary the success it deserves.

The *Iron Age*, whose appearance had become familiar to its readers through many years, has so changed its form as to be hardly recognizable. In its first issue for 1888 it appears in what might, by comparison, be termed the magazine form, being enormously reduced in its dimensions of length and breadth and correspondingly increased in thickness. We have no doubt our contemporary had good reasons for its change in dimensions.

## QUESTIONS AND ANSWERS.

*Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.*

*Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.*

(35) C. H. W., Buffalo, N. Y., writes: I would ask you to advise me in the purchase of a book treating on gold and silver mining; a complete work also on prospecting. *A.*—We have not seen a complete work which treats exclusively on gold and silver mining, and we are inclined to believe that such a work is not published.

(36) A. R., Lathrop, Mich., asks: 1. What is the best way of drawing the temper of a cold chisel? *A.*—We know of no better way than to leave heat enough in the body of the chisel to permit the temper to run down slowly. 2 Can water be too cold for tempering? *A.*—It is generally better to take the chill off the water in very cold weather, especially if hardening a piece that is likely to crack.

(37) E. G., Philadelphia, Pa., writes: 1. Consider you have a piece of new rope calculated to carry a load of 100 pounds, now double the rope, and hang the load on a sheave wheel; will not each part of the rope carry one-half of load? and can you not, where you formerly carried 100 pounds single, now carry 200 pounds? I told a person so, and he said not, and insisted that when a rope is doubled and a load of 100 pounds hung upon it there would still be a strain of 100 pounds on each part of the rope, and will pull apart under the sheave wheel. Will you kindly give me the principle of this, so I can go at him and silence his battery. *A.*—You are right, providing both parts of the rope are parallel. If a rope is doubled as you state it, each part will carry one half of the load; also by doubling the rope, its strength will enable it to carry double the load that it can sustain when it is single. The principle which explains these facts is this: Whatever stress or tension is applied to one end of a rope is transmitted through its whole length. If therefore a rope is suspended at one end and sustaining a load of 100 pounds at the other end, then neglecting the weight of the rope, the stress throughout the rope will be 100 pounds, and the pull on the pin which holds the upper end of the rope will also be 100 pounds. Now assume that instead of the weight of 100 pounds a person pulls at the end of the rope with force equal to the weight, then the stress on the rope will not be changed. Also assume, that during the time the person is pulling, he leads the rope around a pulley or sheave which is held fast (always pulling with the same force), then that part of the rope which lies between the pulley and the pin to which the rope is attached will still be subjected to a stress of 100 pounds, and since the same stress is transmitted throughout the whole length of the rope, it follows that the stress on that part of the rope which lies between the pulley and the person must also be equal to 100 pounds. If now both parts of the rope are parallel to each other, we may say that there are two forces each equal to 100 pounds, acting in the same direction and tending to pull the sheave or pulley towards the person and pin, and therefore the total force which the pulley must resist is equal to 200 pounds This principle may be explained in another way. Assume that a pulley is fixed to a celling, and a rope passed over the pulley with a 100 pound weight attached to one end of the rope, then to prevent the weight from falling, a weight of 100 pounds must be attached to the other end of rope. In this case the stress through the whole length of the rope is equal to 100 pounds (not 200), and it must be evident that the pulley sustains 200 pounds. 2. Will you also tell me how to compound a lathe to cut to a pitch, say for example a $\frac{5}{8}$ pitch? *A.* See answer to Question 15.

(38) **Subscriber, Providence, R. I., asks:** 1. How many pounds pressure will it take to shear cast-steel plates ⅛ inch thick, the angle of shear blades being three degrees? *A.*—About 9,600 pounds. 2. Will blades of this angle curl the stock? *A.*—Yes. 3. At what speed can shear blades be satisfactorily run to shear steel plates? *A.*—The speed of the shear plates should be such as will allow sufficient time for adjusting the work during the time the blade moves upward. 4. According to "Nystrom" it takes from 16 to 24 tons pressure per square inch to shear wrought iron, but he says nothing about steel. I have taken the power required as 75 per cent. of the ultimate tensile strength of cast-steel. Is this correct? *A.*—Weisbach gives for the ultimate shearing strength of wrought-iron 50,000 pounds per square inch, and for fine cast-steel 92,400 pounds per square inch.

(39) **Subscriber, Cimarron, Colorado,** asks: 1. Will you please inform me of the proper method to pursue to obtain the exact point of suspension of link from saddle on locomotives. *A.*—You will find the whole method explained in a series of four articles headed, "Laying Out Link Motion," the first of these having appeared in the AMERICAN MACHINIST, May 10, page 7, 1884. 2. What is the proper radius of link, whether from the center of main driving shaft to center of rocker shaft, or from main shaft to center of inside rocker arm with shaft and arm placed perpendicular? *A.*—The latter radius is correct; that is, set the inside rocker arm perpendicular to line of motion, and then measure from the center of main driving axle to the center of rocker pin. Occasionally we find master mechanics who use a radius slightly different from the one given, but we believe the one given is usually adopted, and in practice will give the best results.

(40) **J. T. E., Duluth, Minn., writes:** 1. To have a good mechanical education what branches of mathematics is it necessary or desirable to study? *A.*—Arithmetic, elementary geometry, algebra, drawing, trigonometry, analytical geometry, descriptive geometry, analytical mechanics, applied mechanics, books relating to the strength of material, engineering and the construction of machinery in general. 2. If one has not a table of logarithms at hand by what process can they be found? *A.*—The process is given in any good book treating on algebra. 3. Are Legendre and geometry the same or different branches of mathematics? *A.*—They are the same, "Legendre" is simply the name of the author of one of the best elementary geometries. 4. Are your new Handy Binders suited for temporary use? What I wish is to use it only on current volumes and change when complete, as I then send papers to bindery. *A.*—We believe that the Handy Binders are well adapted for your purpose.

(41) **H D., Philadelphia, Pa., writes:** 1. I wish to ask what would be the proper size of ports of an engine, condensing with steam at about one pound pressure; cylinder, 8 inches diameter, 10 inches stroke. I am using one of these engines for light driving, and have great satisfaction with it. I only carry a pressure of about one pound in the boiler. Also can you send me a sketch of ports and valve (common slide valve) best adapted to this engine? *A.*—The steam ports should be about ¾ inch wide, 7 inches long, exhaust port about 1½ inch x 7 inch. The reason for making the ports of such a large area, when compared with the transverse area of the cylinder, is on account of the low pressure. We would advise to give the valve a very small amount of lap, say ⅛ of an inch; the other dimensions of valve you can easily find by following the instruction given in the AMERICAN MACHINIST, page 5, Sept. 5, 1885; page 2, Oct. 10, 1885; page 1, Oct. 24, 1885. What piston ring is the best for non-leakage and easy for working? *A.*—Prof. John E. Sweet's packing, in our issue of Dec. 10, 1887, will probably give the best satisfaction. If you want a cheaper arrangement, turn three or four peripheral grooves into the piston for steel packing rings about ⅛ of an inch square. Of course packing rings of this size are not suitable for cylinders much larger than 8 inches in diameter. It seems to us that, since you have an engine working as satisfactorily as you say it does, you would adopt and follow its design in building a new engine.

(42) **X. Y., Springfield, Ohio, writes:** It is well known that the greater velocity with which an elastic ball strikes an object such as a wall, the greater is the distance to which the ball will rebound. Does this rule hold good in case the object struck is comparatively light, and in motion towards the ball; such as the case of a ball being struck by a bat in the hands of a player? If not, why not? *A.*—After the collision of two elastic bodies, they will not move together, but each one will have a velocity of its own, and so far the law relating to the collision of elastic bodies holds good in all cases. Let $A$ represent the weight of one elastic body, $B$ the weight of another elastic body, and let $a$ represent the velocity of the former, and $b$ the velocity of the latter. In D. Olmsted's Natural Philosophy we find the following formulæ: When two elastic bodies are moving in the same direction, then after impact the velocity of the body $A$ will be

$$(1)\ \text{velocity of } A = \frac{(A-B)\,a + 2\,Bb}{A+B}$$

and the velocity of the body $B$ will be

$$(2)\ \text{velocity of } B = \frac{(B-A)\,b + 2\,Aa}{A+B}$$

When the same two bodies move in opposite direction then after impact the velocity of $A$ will be

$$(3)\ \text{velocity of } A = \frac{(A-B)\,a - 2\,Bb}{A+B}$$

and the velocity of the body $B$ will be

$$(4)\ \text{velocity of } B = \frac{(A-B)\,b + 2\,Aa}{A+B}$$

We have given these rules in the shape of formula, so as to enable us to compare quickly one with another. Now assume that the weight of the body $A = 30$ pounds and that of $B = 30$ pounds; velocity $a$ before impact = 50 feet per second, and $b$ 80 feet, then in order to find the velocity of $A$ after impact, we simply substitute in formula (1) the foregoing figures for the letters, and thus obtain

$$\text{velocity of } A = \frac{(30-30)\,50 + (2\times 30\times 80)}{30+30} = 80$$

feet per second. Now to find the velocity of the body $B$ we substitute in formula (2) the foregoing figures for the letters and obtain

$$\text{velocity of } B = \frac{(30-30)\,80 + (2\times 30\times 50)}{30+30} =$$

50 feet per second. From these results we see that after impact of two equal elastic bodies moving in the same direction, each takes the original velocity of the other and both will continue to move in the same direction as before. To obtain the velocities of two equal elastic bodies moving in opposite directions after impact, we apply formulæ 3 and 4, and the results will show that in this case also, each body will take the original velocity of the other, but each will rebound and move in an opposite direction. If a greater body impinge on a less one at rest, the impinging body goes forward, but slower than before, and the other precedes it with a greater velocity than the impinging body first had. If a less body impinge on a greater one at rest, it rebounds and the other goes forward, but with less velocity than that which the impinging body first had. If a perfect elastic body strikes an immovable body, the former will rebound with the same velocity as it had the moment before impact. From these remarks it will be seen that when we consider the bat and ball as perfect elastic bodies, the ball under certain conditions will rebound, but it may also be thrown with such a great velocity that it will break the bat. The results obtained by the foregoing formula must only be considered to be approximately correct, because solid bodies are not perfectly elastic.

## BUSINESS SPECIALS

*Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.*


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Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Berryman Patent Feed Water Heater and Purifier, and the Economic Boiler Feed Pump. Benj. F. Kelley, 91 Liberty st., New York.

Nicholson & Waterman, Providence, R. I., one 46 in. horizontal boring mill; 5 in. cutting-off machines; 14, 16, and 30 in. engine lathes.

The Brown & Sharpe Mfg. Co. have placed at No. 23 S. Canal st., Chicago, Ill., a sample line of milling machines and other machinery with S. A. Smith.

Machinists' supplies, brass goods, m'f'rs' supplies, polishing materials, all kinds wire, metals, etc.; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Jan. 14, p 14. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.


The Dexter Machine Co., Dexter, Maine, are building a fine grade of engine lathes and upright drills which they sell at a reasonable price.

W. H. Hoffman, consulting engineer, 94 Liberty st., N. Y. Mechanical engineering in all its branches; working drawings for the transmission of power by steam, water, air and electricity.

Patents relating to machinery should be secured by experienced mechanics acquainted with the law. Write to A. K. Mansfield & Co., mechanical engineers and patent experts, 280 Broadway, N. Y.

New book on gears; Tables giving 3,094 diameters, with rules for calculation of movements of shafts, etc.; sent on receipt of P. O. Note; price, 50 cts. Address C. B. Long, M. E., Worcester, Mass.

Hot Water Supply. A practical treatise on the fitting of hot-water apparatus for domestic and general purposes. By F. Dye. 82 pages, with 25 illustrations. 12mo., cloth, $1. Send for catalogue. E. & F. N. Spon, 35 Murray st., N. Y

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

The series of articles by J. G. A. Meyer, on "Practical Drawing," now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October, 23, 1886 issue, and up to and including January 14, 1888 issue, 41 articles have been so far published. Copies containing these articles, sent by mail to any part of this country or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton street, New York.

"Modern Locomotive Construction," by J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 56 articles have thus far appeared up to and including the January 21, 1888 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton street, New York.

The 28 in. lathe illustrated in the AMERICAN MACHINIST some weeks ago has proved very satisfactory. They have been quite generally distributed, being now in Maine, Chicago, Texas, Mexico, and other sections. It is the best lathe for the price now produced, being mechanically designed and strongly proportioned. They are all carefully tested before leaving the shop, and their accuracy guaranteed. These lathes and a large assortment of other machine tools can be seen at the warerooms of Fraser & Archer, No. 121 Chambers street, New York.

## MANUFACTURES

C. A. Mee is interested in building a shingle mill at Charleston, Tenn.

Anniston, Ala., has an electric street railway in process of construction.

W. H. Coffman is interested in building an iron furnace at Morristown, Tenn.

Sithen & Dow will start a sash and door manufactory at Hot Springs, Ark.

C. W. Briggs proposes to start a wooden bowl factory at Kissimmee, Fla.

J. B. Curry, Huntsville, Ala., has formed a company to manufacture the Curry cultivator.

P. B. Matthews, of Aiken, S. C., contemplates building a carriage factory at Bessemer, Ala.

It is reported that the Davidson Motor Company of Cincinnati, Ohio, will build works at Nashville, Tenn.

The Galveston (Texas) City Railway Company is canvassing the question of running its cars by electricity.

The Central Railroad and Banking Company, Savannah, Ga., will build a large cotton compress at Montgomery, Ala.

The Knoxville (Tenn.) Woolen Mill Company has prepared plans for improvements that will double the capacity of its mills.

The Westinghouse Air Brake Company, Pittsburgh, Pa., has increased its capital stock to 2,000,000 in order to erect a new factory at Turtle Creek, near Pittsburgh.

The Lucy Furnace, Pittsburgh, Pa., recently posted a notice of a reduction of 12½ per cent. in wages. This was met by a demand on the part of the men for an advance of 5 per cent.

The car construction shops now being built by the Louisville and Nashville Railroad at Decatur, Ala., are the largest of the kind in the South. The company has about 60 acres of land which it will utilize.

The Pulsometer Steam Pump Company has removed their office to 120 Liberty street, New York, where they have fitted up convenient offices and work rooms. The company has been newly reorganized.

Peter Burden & Co., of Greenpoint, L. I., are erecting a large and commodious building, rendered necessary by the continued increase of their business, and will place in same a Wainwright feed-water heater.

It is reported that large repair shops will be built by the Pennsylvania Railroad Company, at a point somewhere near Grapeville, Pa. It is said the road will, this year, add 100 locomotives to its equipment west of Pittsburgh.

The Davidson Steam Pump Company, 77 Liberty street, New York, has been awarded a gold medal for their exhibit of steam pumps at the fair of the Massachusetts Charitable Mechanics' Association, recently held at Boston.

The Water Waste Prevention Company, 143 Nassau street, New York, has issued a catalogue of the Thomson water meter. The meter is fully illustrated and described. The Thomson meter is one of the three meters, the use of which is authorized in New York City.

The Standard Steel Casting Company, Thurlow, Pa., have commenced the construction of an addition to their works, 130 x 95 feet, and put in a traveling crane of 20 tons capacity. The company will also build a new open-hearth steel furnace, which, with their present one of 10 tons, will enable them to handle very large castings.

E. P. Allis & Co., of Milwaukee, Wis., have taken the contract to erect a 150 bbl. mill for the Merchants and Farmers' Milling Company, at Montrose, Col. It will be a three story brick building with basement, and will contain a full roller system with Gray rolls, round reels, centrifugals, Reliance purifiers, and a 14 x 36 Reynolds-Corliss engine.

The Sheffield and Bessemer Mining Company capital stock, $200,000, has been incorporated. The incorporators are H. F. DeBardeleben, of Anniston, Ala.; Jacob G. Chamberlain, of Jasper, Ala.; David Roberts, of Charleston, S. C.; and Henry Tompkins, of Atlanta. The company will open large coal mines, tapping the Pratt seam on a line of the Kansas City, Memphis, and Birmingham railroad.

A charter of incorporation has been granted by the Secretary of State to the Victor Machine Company, of Columbus, O. The incorporators are Charles C. Griswold, Colonel James Kilbourne, W. H. Slade, J. P. McCune and A. R. Appleman, prominent business men and capitalists of Columbus. The authorized capital is $500,000, and it is the intention of the incorporators to purchase the material, machinery, and patents of the Newark Machine Company, which has been temporarily located at the old Gill car works.

A Lima, Ohio, dispatch says: The Standard Oil Company has just closed some more real estate purchases, making 665 acres in all that they own in this city and vicinity, and the next improvement after the completion of the big pipe line will be the erection of large paraffine works near their refinery, and also immense cooperage shops, which will give employment to nearly 2,000 more men and over $1,000,000 will be expended in the enterprise. As fast as the tanks in the Eastern field are emptied they will be shipped to Lima and an entire change of base taken, and it is estimated that by selling its Eastern oil and making the change to the Ohio field, the Standard will make from $25,000,000 to $30,000,000.

The Muskegon (Mich.) Curtain Roll Company yesterday completed the sale of its extensive factory and plant here to Stewart Hartshorn, of East Newark, N. J. Mr. Hartshorn is the inventor and patentee of the spring fixtures for curtain rolls, and the largest dealer in curtain rolls in the world. The manufactory here will be run to its full capacity, and hereafter, instead of manufacturing for the trade, the curtain rolls will be completed here, fixtures and all, and he will manufacture for his own extensive trade. The concern thus passes into strong and capable hands, and will continue to increase its capacity and to hold front rank among manufactories of its kind.—*Muskegon Weekly Chronicle.*

The Mexican Central Railway Company has ordered from the Baldwins seven freight locomotives two to be delivered in January, two in February, and the rest before April 1. These are in addition to 12 locomotives previously ordered to be delivered in March. In addition to 200 box cars and 50 stock cars just received, the company has ordered 50 more box cars, and will soon give an order for 50 additional, making 300 box cars in all and 50 stock cars. All the new freight cars are to be of 20 tons capacity. There is pressing demand on this line for the new rolling stock, as the freight department is in urgent need of cars to handle the growing business of the road.

The *Daily Hot Blast*, Anniston, Ala., says: It will be remembered that the city council granted the franchise for the erection of gas works in Anniston to Mr. T. Gardner Foster, president of the Montgomery and Talladega gas companies. The franchise was granted in July last, and Mr. Foster is given one year in which to complete the work. A letter from him announces that work will be begun shortly. One reason of the delay is that it is the intention of the gas company to purchase their pipes from the Anniston Gas Company, and they have been waiting until the pipe works get under way and in a position to supply the pipe. Doubtless a few months more will witness the illumination of the city by gas as well as by the electric lights.

A strong organization has been formed in Milwaukee, under the title of the Thayer Manufacturing Company, with a paid up capital of $150,000 to manufacture the journal bearing for cars, introduced some time ago by Mr. F. W. Thayer, of that city. The officers of the company are H. C. Buhoup, president; F. W. Thayer, secretary; J. P. Murphy, treasurer. Under the patents used the brass bearings are coated with a soft metal lining which appears to have great wearing qualities while reducing the friction to a minimum. The company has been fortunate in securing as its general representative Mr. Robert C. Libbey, who has been connected with railway business for thirteen years, having for five years or more represented the American Brake Company in the East, and latterly having charge of their New York office.—*Railway Age.*

The Betts Machine Company, Wilmington, Del., write us: Some months ago you had a notice of a 66" lathe, with two carriages, that we built for the Otis Iron and Steel Company, of Cleveland, Ohio. We send you with this a chip of steel that was taken off with the lathe. Mr. Wellman, the superintendent, informs us that in turning a 24" steel shaft a few days ago, one carriage reduced it 4¼" and the other carriage reduced another part of it 3½" diameter, with 1-12 in. feed on both, at the same time. Have you any record that will beat this?

### Machinists' Supplies and Iron.

NEW YORK, Jan. 12, 1888.

Transactions in American Pig continue light, with small prospects of immediate change. We quote Standard Lehigh brands, No. 1 X Foundry, $21 to $21.50; No. 2 X, $19 to $19.50; Grey Forge, $16 to $17.

Scotch Pig—Coltness, $22 to 22.25; Glengarnock, $21 to $21.50; Gartsherrie, $21.50 to $22; Summerlee, $21.75 to $22; Eglinton, $20 to $20.50; Langloan, $20 to $20.50; Dalmellington, $21 to $21.50; Clyde, $20.50 to $21.

Lead—The market is dull, and prices nominal. Quotations are 4.85c. to 4.95c. for spot.

Copper—There is but little doing in copper except in a speculative way. Quotations at 16⅜c. are made.

Antimony—Hallett's, 11¼c.; Cookson's, 15c.

Spelter—Refined 6½ to 6¾c.

Tin—Jobbing lots of Banca have sold at 37c. to 37½c.; Straits and Malacca 37¼c. to 37⅝c.

## *WANTED*

*"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.*

Wanted—Men to sell planes, see page 11.

Wanted—A young man as assistant draftsman. Address, with references, Box 719, Worcester, Mass.

A mech'l draftsman and designer has had, practical shop exp., wants position. H. E., AM. MACHINIST.

Wanted—Position by a high rate machinist; first-class gunsmith; experience in building instruments and tools. Active, AM. MACHINIST.

Situation wanted by a first-class machinist; one can work on lathe, vise, and planer; capable of handling men. J. A. D., AM. MACHINIST.

Wanted—By draftsman, position where he can work into a business; has technical education and experience on special machinery; age 24. F. G. H., AM. MACHINIST.

Wanted—Situation as superintendent or assistant of machine works; building engines preferred; designer and draftsman; understands indicator. H., AM. MACHINIST.

Wanted—Foreman in foundry department of stove works; must be a first-class practical stove plate moulder in the New England system. Rathbone, Sard & Co., Albany, N. Y.

Wanted—A good machinist with push and executive ability; capable of handling about 30 men in general machine shop; no hurry; give age, experience and references. D., AM. MACHINIST.

Wanted—Situation as foreman or head workman in a pattern shop, by a young, active, and reliable man; 12 years' experience in general machinery patterns; is a fair draftsman and an expert in all kinds of gearing; now in charge of a shop, but wishes a change. X. X. X., care AM. MACHINIST.

## ✝ MISCELLANEOUS WANTS. ✝

*Advertisements will be inserted under this head a 25 cents per line, each insertion.*

Crescent steel tube scrapers are unquestionably the best. Crescent Mfg. Co., Cleveland, Ohio.

Crescent boiler tube cutter, for setting new and removing old tubes. Crescent Mfg. Co., Cleveland, O.

Wanted—Parties having machinery specialties to build, to correspond with. Box 75, AM. MACHINIST.

For Sale—54" x 54" x 17' iron planer; 2 heads on crossrail, used a short time; to make room for a 60" planer. John Steptoe & Co., Cincinnati, Ohio

Wanted—A Berryman patent feed-water heater and purifier; give full particulars, with size of openings for the exhaust; lowest cash price. P. O. Box 1840, New York.

Steam users who desire to keep their boilers clear of scale at a cost of 10 cents a week, should read the card of the Pittsburgh Boiler Scale Resolvent Company on this page. It will pay them.

A. C. Christensen, 26 Church st., N. Y., mech. and hydraulic engineer, late chf. draftsman at H. R. Worthington. Designs and working drawings of water-works, pumps, gen. mach. and pat. drawings.

Engine and boiler for sale; an 80 horse-power Buckeye automatic engine and 120 horse-power boiler with heater, exhaust injector, damper regulator, piping, etc., in excellent order. Will be sold at a great bargain. Address P. O., Box 40, Troy, N. Y.

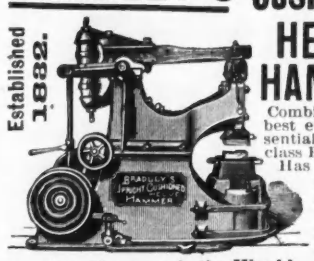

THE
Association of Engineers
OF
WAYS AND COMMUNICATION,
OF
ST. PETERSBURG, RUSSIA.

Having special Government charter favoring negotiations on a large scale and doing already a heavy business in Europe, invites American Manufacturers, Inventors and Engineers of all branches to participate in the permanent exhibition at St. Petersburg with first class prospects of doing a profitable business.

GENERAL AGENT FOR AMERICA,
A. WARSCHAWSKY,
P. O. Box 3,348. 14 Dey St., N. Y.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER

Established 1832.



Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other Hammer in the World.

Bradley's HEATING FORGES

Established 1832

With a manufacturing experience of over half a century, we recommend these machines to be the best, simplest, most durable and combining all the essential elements.

For hard coal or coke. Indispensable in all shops to keep Bradley's Cushioned Hammers and men fully employed and reduces cost of production.

BRADLEY & CO., Syracuse, N. Y.

STEPHENS PATENT VISES

ONE-HALF TIME and LABOR saved by using this solid, strong, durable, firm-hold, quick-working Lever (Not Screw) Vise. Has Improved Taper-Pipe and other attachments. Sold by the trade. Send for circular

TOWER & LYON,
95 Chambers Street, New York.
Successors to MELVIN STEPHENS.

STEAM PUMPS for Hot or Cold, Fresh or Salt Water; for Oils, Naphtha, Tar; for Cane Juice, Liquors, Syrups, Scum; for Ammonia, Alkalies, Extracts, Acids; for Thick, Volatile, Viscous or Foul Liquids, etc. VACUUM PUMPS of the highest efficiency. FILTER PRESS PUMPS. Air, Gas and Acid Blowers. AIR COMPRESSORS. Etc. BUILT BY

GUILD & GARRISON, Brooklyn, N. Y.

Baker's Common Sense Oil Filter.

Is the most **Simple, Neat, Ornamental, Effective, Complete** and **Convenient OIL FILTER** in the Market. The whole **operation** is **visible,** and any ordinary man can operate it **successfully.** It will pay for itself the first year, if a little pains is taken to catch the waste oil from your Engine, Dynamo, Shafting, etc., etc. Manufactured and for sale by **CHAS. F. BAKER,**
223 Third Ave., S. E., MINNEAPOLIS, MINN.

Thinking engineers recognize that the use of chemicals in steam boilers to prevent incrustations has had its day.

The Pittsburgh Boiler Scale Resolvent has its basis in a particularly greasy petroleum, specially selected for the purpose, which has a vaporizing point of nearly 600 degrees Fahrenheit, and is wholly free from tar or wax. It acts by giving a slightly greasy coating to the inside of the boiler, like the touch of a sweaty hand on a window pane, but sufficient to prevent adhesion. It gives to the water a greasy character so slight as to be scarcely perceptible, but sufficient to prevent the minerals contained therein from clinging together and crystallizing. It also prevents corrosion of the boiler from acids contained in the water.

The cost will not exceed 10 cents per week for a 50 horse-power boiler. Send for circular containing further information and testimonials from the largest steam users in America.

PITTSBURGH BOILER SCALE RESOLVENT CO.,
Chemists and Engineers,
Pittsburgh, Pa.

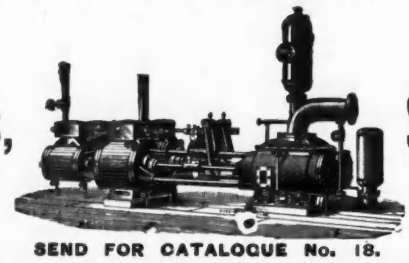
GEO. F. BLAKE MANF'G. CO.
BUILDERS OF EVERY VARIETY OF

95 & 97 LIBERTY ST., NEW YORK. 111 FEDERAL ST., BOSTON.

WATER WORKS PUMPING ENGINES A SPECIALTY

THE DEANE STEAM PUMP CO., Holyoke, Mass.

BUILD Water Works, ENGINES AND Steam Pumping MACHINERY.



SEND FOR CATALOGUE No. 18.

AS we are filling up our works with Engine Lathes of our own make, we offer a variety of second-hand Engine Lathes of various makes, ranging in size from 14 in. x 6 ft. to 23 in. x 10 ft. These Lathes will be thoroughly overhauled and put in first-class order, and sold at reasonable prices.

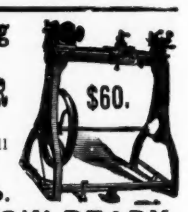
THE HENDEY MACHINE CO., Torrington, Conn.

DIE STEEL IN BARS OR BLOCKS.

For Cutting, Trimming, Stamping Punching, Drop Forging, Bolt and Rivet Heading Dies for Hot or Cold Work.

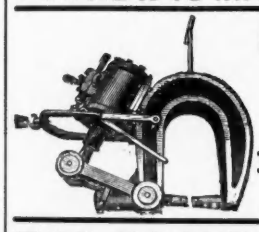
MILLER, METCALF & PARKIN,
CRESCENT STEEL WORKS.
CHICAGO, ILLS. PITTSBURGH, PA. NEW YORK, N. Y.

Sebastian, May & Co.'s Improved Screw Cutting FOOT AND LATHES POWER




Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.
167 West Second Street, CINCINNATI, O.

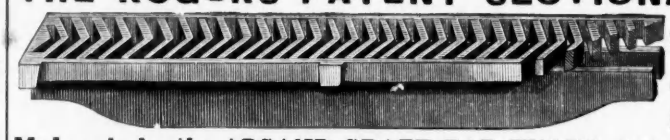
OUR NEW 18 in. POWER ENGINE LATHE IS NOW READY.



U. BAIRD MACHINERY CO.
Pittsburgh, Pa.

MACHINISTS' TOOLS AND SUPPLIES.
Pattern Makers' Tools. Boiler Makers' Tools.
STURTEVANT BLOWERS AND EXHAUST FANS.

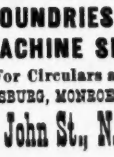
THE ROGERS PATENT SECTIONAL GRATE.



Freedom of EXPANSION and CONTRACTION, so as to prevent WARPING or TWISTING. LIGHT, STRONG AND DURABLE. GIVES A VERY LARGE PER CENT. OF AIR SPACE. Made of the Best Material, and adapted to all Kinds of Fuel. &c.

Made only by the ARGAND GRATE BAR WORKS, 110 Liberty St., N. Y.

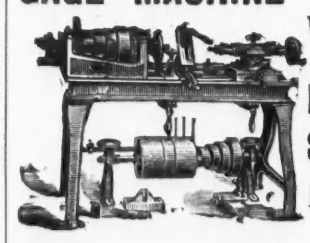
BORING AND TURNING MILLS
LATHES PLANERS DRILL PRESSES
F. P. MICHEL ROCHESTER N.Y.



TANITE
EMERY WHEELS and GRINDING MACHINES
FOR SAW MILLS, FOUNDRIES AND MACHINE SHOPS.
For Circulars address
THE TANITE COMPANY, STROUDSBURG, MONROE CO., PA.
Or H. A. ROGERS, 19 John St., N. Y.

L. S. STARRETT,
Manufacturer of
FINE TOOLS
ATHOL, MASS.
SEND FOR FULL LIST.

GAGE MACHINE WORKS,
Waterford, N. Y.



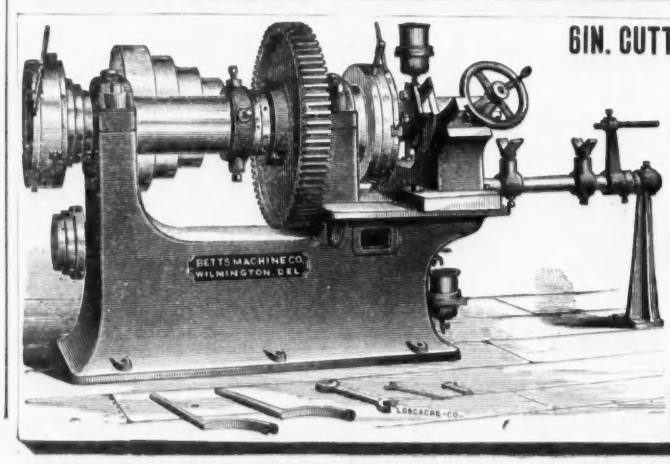
Manuf'r's of
FOX, TURRET AND Speed Lathes AND Brass Finishers' TOOLS.

THE CELEBRATED
HEALD & SISCO CENTRIFUGAL PUMPS
Vertical and Horizontal.

HOOD & HOOD
22 CORTLANDT ST., NEW YORK.

In Writing Mention this Paper.

6IN. CUTTING-OFF MACHINE
MADE BY
Betts Machine Co.,
Wilmington, Del.,
BUILDERS OF
Machine Tools
FOR
RAILWAY
AND
Machine Shops.



## NICHOLSON FILE COMPANY, *Sole Mfrs. of*

**FILES and RASPS Having the Increment Cut, also, FILERS' TOOLS and SPECIALTIES.**

The above illustration represents a device in which files may be held for service in surface filing, and while in this condition READILY SPRUNG, in order to give at the will of the operator, more or less convexity to the working face of the file. It does away with unusual care to obtain a true convexity or "belly" to file sides, and in fact renders great service by enabling the operator to utilize the file to its full capacity.

SURFACE FILE HOLDER No. 4, Adapted to Hold Files 12, 13 14 in. Long.
" " " " 5, " " " " 14, 15, 16 "

**MANUFACTORY AND OFFICE - - PROVIDENCE, R. I., U. S. A.**

## THE NEW "GRESHAM" PATENT AUTOMATIC RE-STARTING INJECTOR

"Invaluable for use in Traction, Farm, Portable Marine and Stationary Boilers of all kinds. No handles required. Water supply very difficult to break. Capability of re-starting automatically immediately after interruption to feed from any cause."

**SEND FOR CATALOGUE.** **RELIABLE AND CHEAP.**

Sole Manufacturers in the United States and Canada,

## NATHAN MANUFACTURING CO.

92 & 94 LIBERTY ST., - - - NEW YORK.

Established in 1874.

## CLEVELAND TWIST DRILL CO.

24 and 26 West Street, Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.

## FITCHBURG MACHINE WORKS.

Manufacturers of

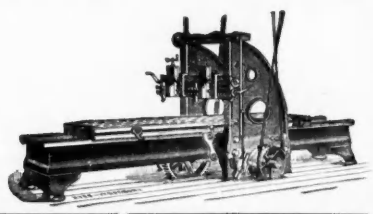
**METAL-WORKING MACHINES.**

Office and Works,

**13 to 21 Main Street,**

FITCHBURG, MASS.

Send for Catalogue (E.)



## "LITTLE GIANT." THE BEST INJECTOR.

For Feeding all Steam Boilers.

**RUE'S EJECTOR,**

Superior to all others for Raising and Forcing Water and other Liquids.

RUE M'F'G. CO., PHILA., PA.

CATALOGUES FREE.

## PATENT OILERS,

CYLINDER SIGHT FEED CUPS, Government Regulation Pop Safety Valves for Stationary, Marine and Locomotive Boilers,

——Manufactured by——

*J. E. LONERGAN & CO., Brass Founders & Finishers,*

211 RACE ST., PHILADELPHIA, PA.

## ROOTS'

**Force Blast Rotary Blower**

FOR

FOUNDRIES, SMITH SHOPS, PNEUMATIC TUBES, VENTILATION, ETC.

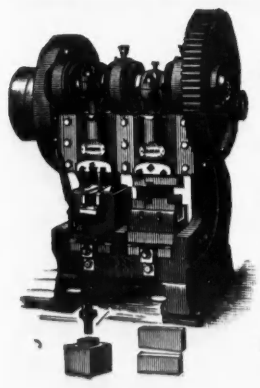
SLOW SPEED.
POSITIVE BLAST,
PERFECTLY BALANCED.

Best Mechanical Construction.

P. H. & F. M. ROOTS, Manufacturers,
CONNERSVILLE, IND.

S. S. TOWNSEND, Gen. Agt. } 22 Cortlandt St.
COOKE & CO., Selling Agts. } NEW YORK.

*In Writing. Please Mention This Paper.*



## BEAUDRY'S DUPLEX Power Press

COMBINING
PRESS, SHEARS AND PUNCH.

**BEAUDRY & CO.**

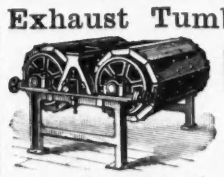
(Formerly of Beaudry's Upright Power Hammer,)

Sole Manufacturers.

Also manufacturers of
HARD COAL HEATING FORGES.

Room 4, MASON B'DG,
70 KILBY ST.,
Boston, Mass.

## Exhaust Tumbling Barrels.



**Henderson Bros.**

MANUFACTURERS,

Waterbury, Ct.,

SEND FOR CIRCULAR.

## 17 INCH ENGINE LATHES

WITH OR WITHOUT
COMPOUND REST AND TAPER ATTACHMENT

THE MULLER MACHINE TOOL Co

EIGHTH & EVANS STS. CINCINNATI, O. U.S.A.

## NOTICE.

We make a Specialty of

**THE BEST UPRIGHT DRILLS,**

In Sizes of 20", 23", 25", 28", 32", and 36".

Be sure and see ours before buying.

CURRIER & SNYDER,
WORCESTER, MASS.

N. B.—We do nice work.

## NEW SELF-SETTING PLANE.

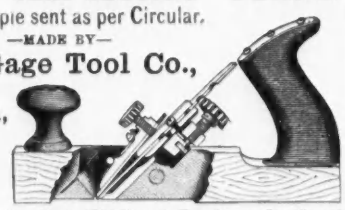
Sample sent as per Circular.

—MADE BY—

**The Gage Tool Co.,**

Vineland,

N. J.



Fourth order from Widdicomb Furniture Co., Grand Rapids, Mich.: "Please ship us 7 No. 2 Smoothing Planes, one No. 11 Jack Plane, one 2-inch blade for No. 4 Smoothing Plane, and 6—1 3-4inch blades for No. 2 Smoothing Planes."

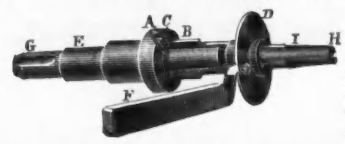
## LECOUNT'S NEW EXPANDING MANDREL.

**Amateur's Size.**

Taking anything from 3/8 to 1 inch inclusive.

Price,.....$5.00

Patented Dec. 25, 1877.



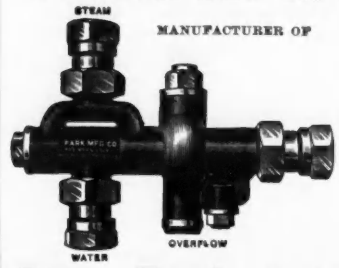

**Machinist's Size.**

| No. | | PRICE |
|---|---|---|
| 1 | ½ to 1 In. | $10 |
| 2 | 1 " 1½ " | 14 |
| 3 | 1½ " 2 " | 18 |
| 4 (with screws) | 2 " 3 " | 32 |
| 5 " " | 3 " 4 " | 44 |

IF YOU WILL TRY THIS TOOL YOU WILL NOT REGRET THE EXPENSE.

C. W. LECOUNT, SOUTH NORWALK, CONN.

## PARK MFG. CO.




MANUFACTURER OF

34 Beach Street, Boston Mass.

**The Park Injector,**

EJECTORS AND JET APPARATUS.

## HENRY CAREY BAIRD & CO.,

**Industrial Publishers, Booksellers and Importers,**

**810 Walnut St., Philadelphia.**

☞ Our New and Revised Catalogue of Practical and Scientific Books, 80 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

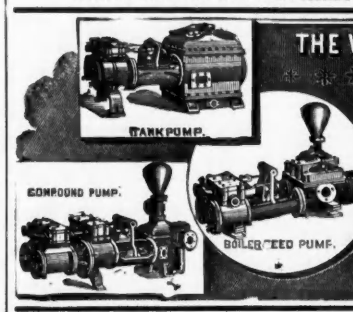
## MONTGOMERY & CO.,

105 FULTON ST., NEW YORK,

**TOOLS, SUPPLIES AND MACHINERY**

FOR ALL BRANCHES OF THE MECHANICAL TRADES.

Illustrated Catalogue (300 pages) mailed on receipt of Fourteen Cents.

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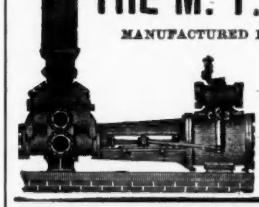

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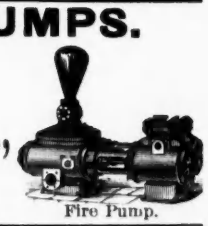

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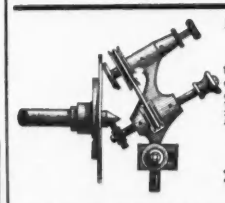

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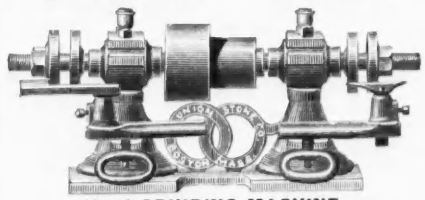

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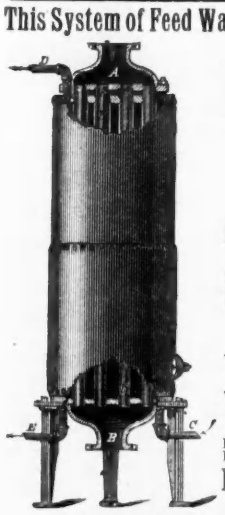

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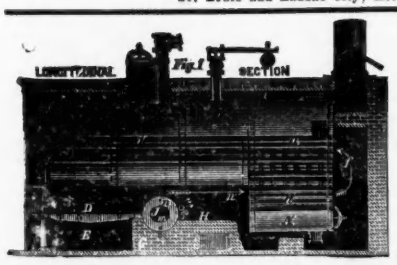

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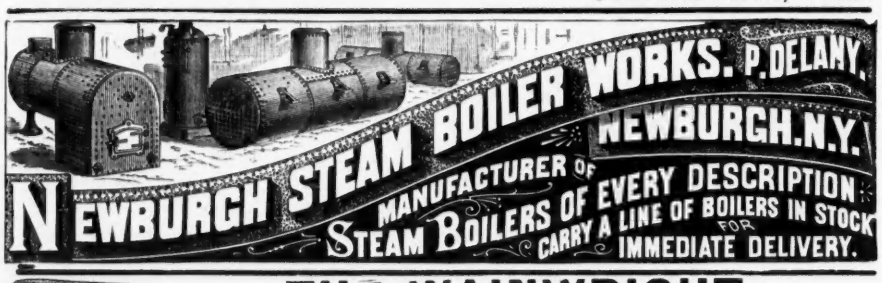

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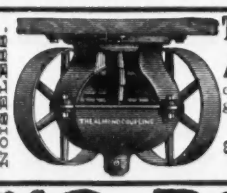

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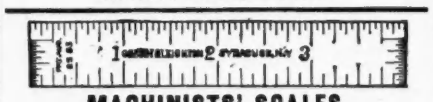

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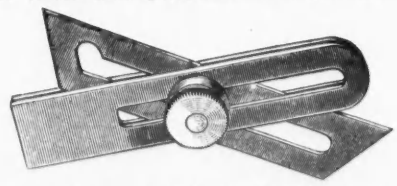

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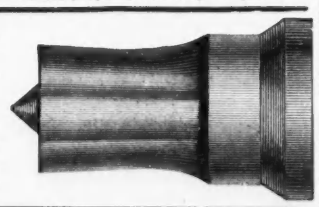

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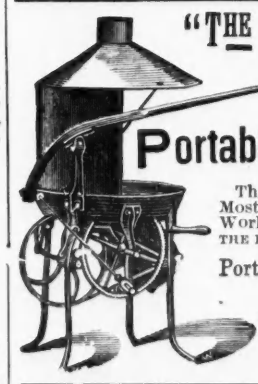

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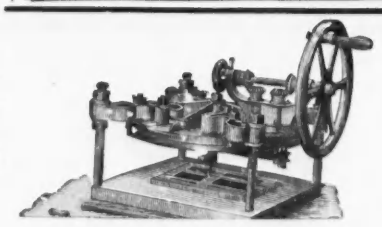

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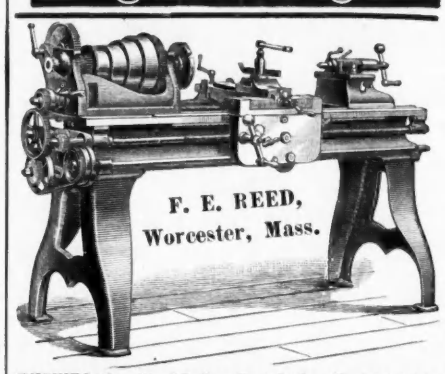

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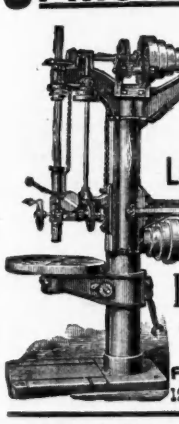

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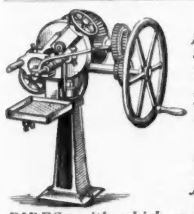

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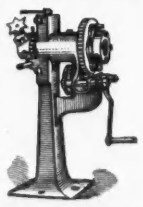

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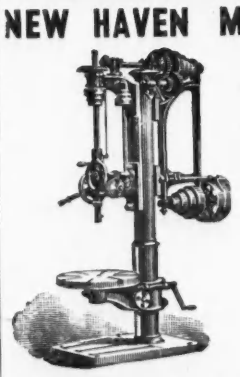

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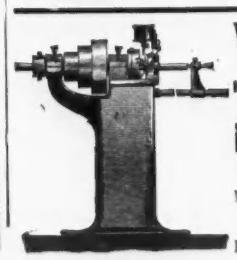

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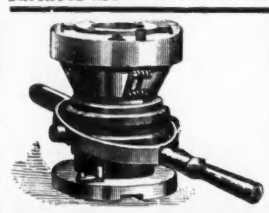

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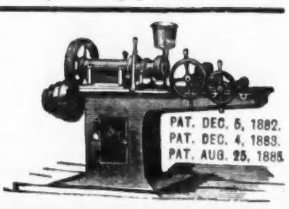
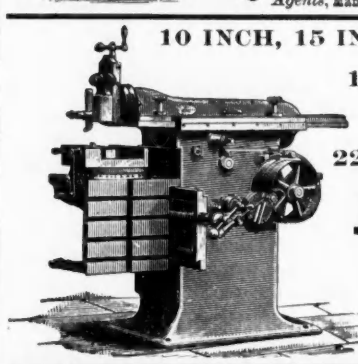


PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883.
PAT. AUG. 25, 1885.



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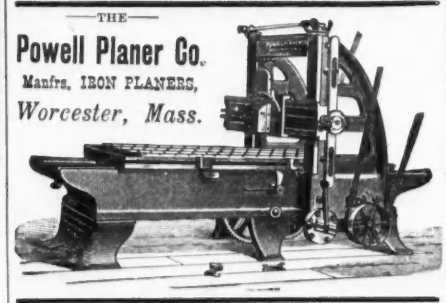

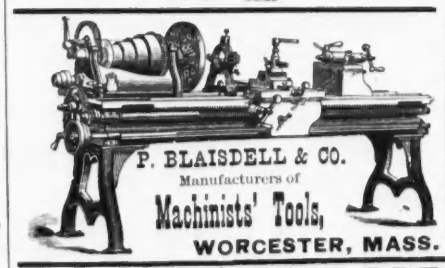

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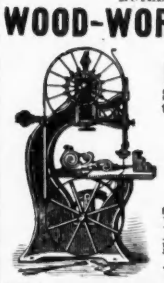

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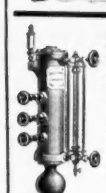

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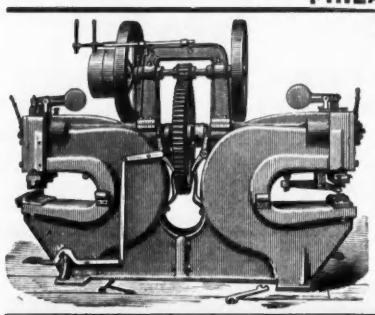

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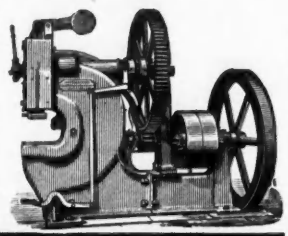

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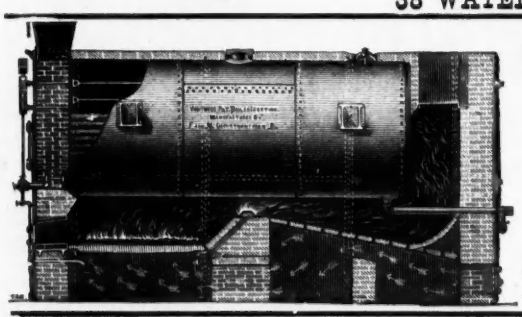

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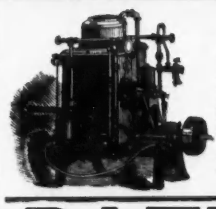

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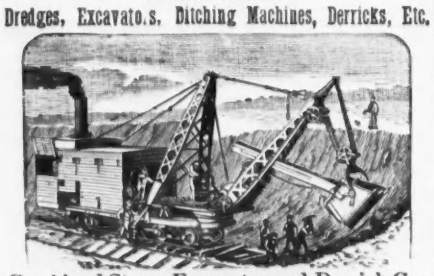

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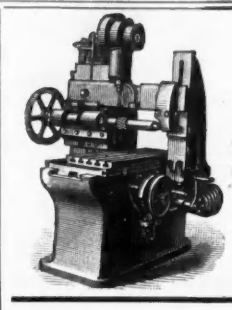

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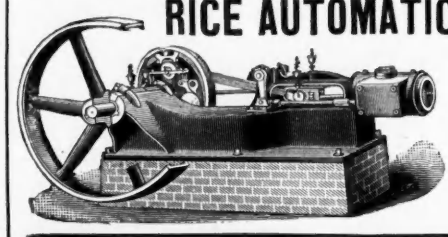

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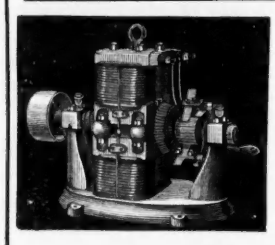

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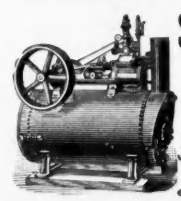

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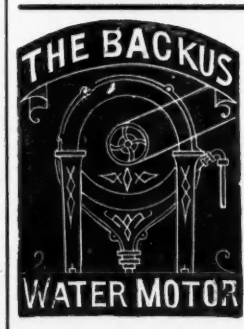


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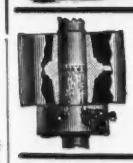

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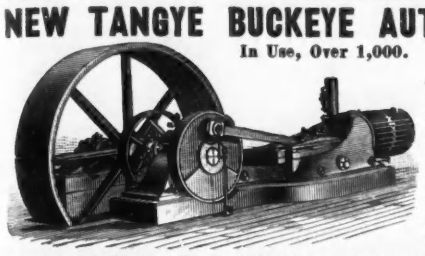

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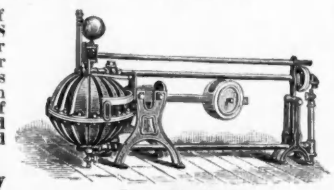

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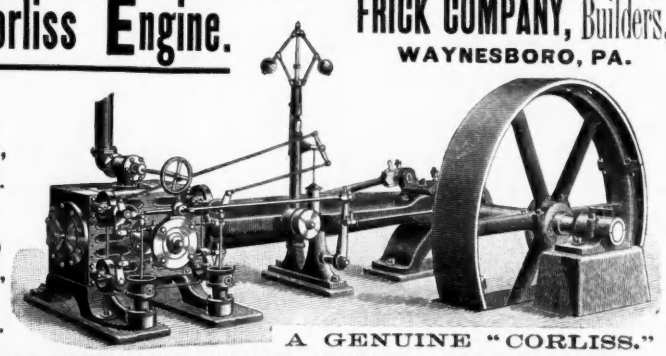

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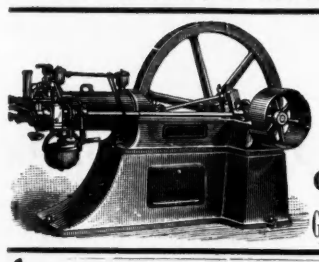

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| 1620 in. x 6 8-10 & 12 ft. | | Bridgeport | new. |
| 16 in. x 6 | " | Blaisdell, | " |
| 18 in. x 8 ft. | " | Blaisdell, | " |
| 24 in. x 10-14 & 20 ft. | " | Ames, | " |
| 23 in. x 8 12 & 14 1-2 ft. | " | Bridgeport, | |
| 24 in. x 16 ft. | " | New Haven, | good order. |
| 30 in. x 14 ft. | " | W. and L. pattern, | new. |
| 39 in. x 15 ft. | Eng. Lathe | Lowell, | " |
| 64 in. x 30 ft. | Engine Lathe, | Niles, | good as new |
| 16 in. x 42 in. | Planer | Bridgeport, | new. |
| 22 in. x 4 ft. | " | Pease, | new. |
| 23 in. x 6 ft. | " | Powell, | " |
| 22 in. x 5 ft. | " | Hendey, | new. |
| 26 in. x 5 ft. | " | Biglow, | good. |
| 26 in. x 7 ft. | " | Brettell, | new. |
| 30 in. x 7 ft | " | New Haven, | fair. |
| 30 in. x 8 ft. | " | Hewes & Phillips, | new. |
| 30 in. x 10 ft. | " | Powell. | |
| 12 in. Shaper, | | Traveling Head, | new. |
| 12 in. | " | Hewes & Phillips, | " |
| 13 in. Stroke, 9 ft. Bed, Trav. Head Shaper, | | Barr, | A 1. |
| 24 in. Shaper, | | Bridgeport, | new. |
| 34 in. | | Wolcott, | " |
| 32 in. Drill, | | Bickford, | A 1. |

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16-18-20-23-25-28-34 in. Drills. 30 in. Radial Drill.
No. 5 Screw Machine. Jones & Lamson.
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Merrill Drops, 800 lbs. good order.
Bement 2250 lb. Steam Hammer.
Milling Machines, Screw Machines, Slate Sensitive Drills, Gang Drills, and full line of all kinds of Machine Tools.
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**Friction Pulleys, Clutches and Elevators.**

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We are now making from entirely new designs, *extra heavy* 17", 19", 21", 24" and 27" **Engine Lathes** (the most popular sizes), of which we are making a specialty, and manufacturing in lots of not less than 100 at a time.

We make no charge for extras. Every lathe is furnished with *hollow spindle*, the 19" with 1⅝" hole, and 21' with 1⅞" hole. Every lathe has substantial *compound rest*, heavy tool post (bar steel), rest to turn full swing, *following rest* with adjustable jaws to take any size from 2½" down, with extra tool for shafting. Full set of gears to cut from 2 to 18 threads including 11½ pipe thread. *Automatic stop on carriage. Separate screw and rod feed*, and the most substantial and easily managed *taper attachment* made. Cones and gears of large diameter and wide belt. Studs, screws and small gears are *steel or gunmetal*. Webbed live heads, heavy tail stocks. No worm or worm gears, no weak reverse plate. *Perfect lubrication for all running parts*, including carriage.

Lead screw inside of shear, double nut (cut from solid), and taking hold of carriage directly under the line of strain. Friction counter-shaft, the most durable made. Our prices are reasonable for cash, and from which no deviation will be made. Our written guarantee accompanies every lathe.

### GUARANTEE.

We guarantee this lathe to be equal in workmanship, truth, accuracy, solidity, material and finish, to the best made, and hold ourselves legally liable for this guarantee.

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**Machine Tools,**

159, 161, 163 and 165 EGGLESTON AVE.,

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**CINCINNATI, OHIO.**

(See our advertisement on last page.)

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Horizontal or Vertical, Direct Acting or Beam, Condensing, Non-Condensing or Compound.

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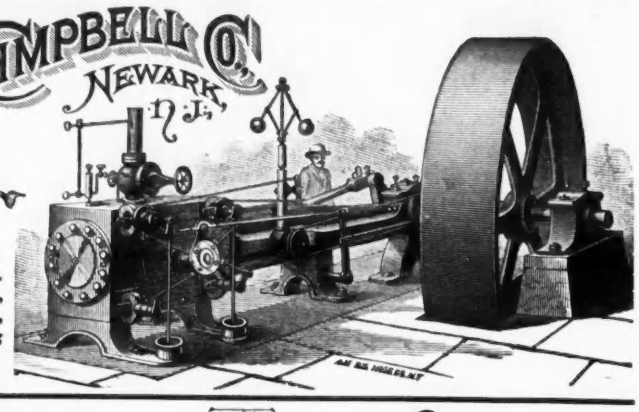

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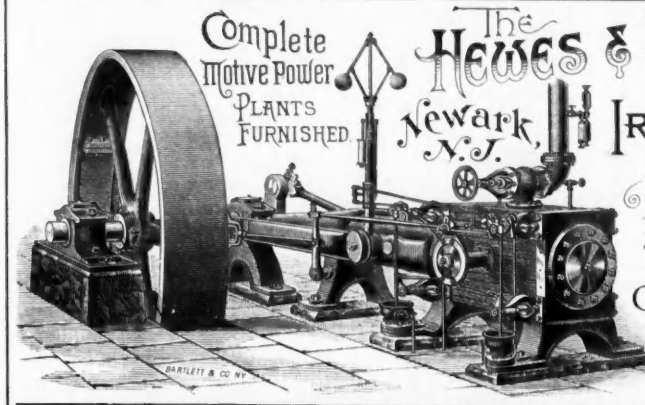

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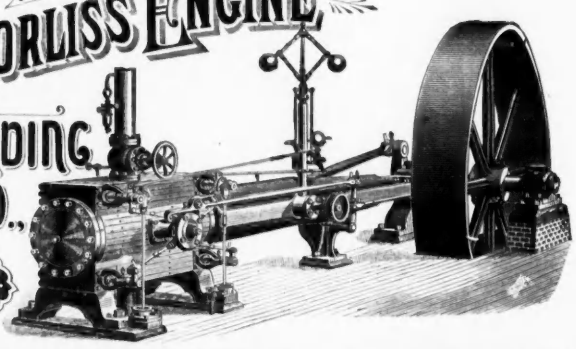

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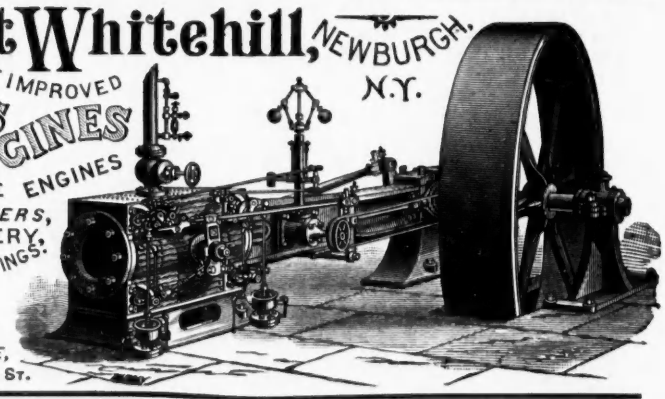

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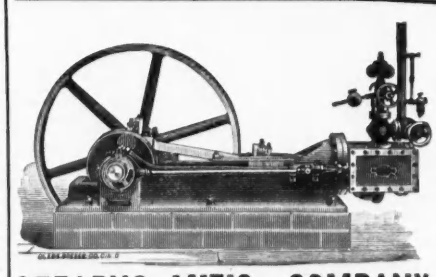

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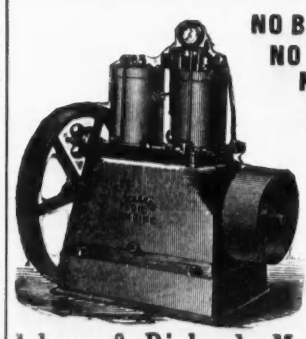

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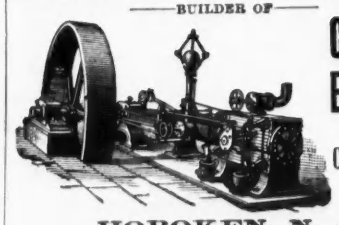

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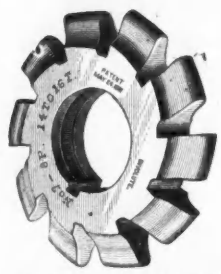
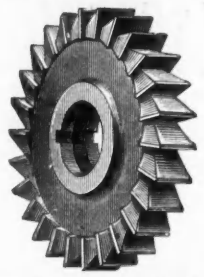
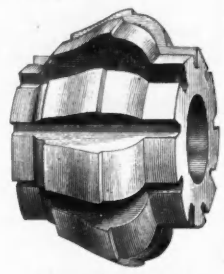


INVOLUTE GEAR CUTTER.



SIDE MILLING CUTTER.



FORMED CUTTER.

Coincident with the rapid and wide extension of the use of Milling Machines, has come an increased demand for Milling Cutters. Without good cutters, the efficiency of Milling Machines is much abridged.

In extending the product of its Milling Department, the BROWN & SHARPE M'F'G Co. has made many new varieties of Milling Cutters, and in order to supply the wants of customers, has found it necessary to greatly increase the number carried in stock. The INVOLUTE GEAR CUTTERS in stock are from 3 to 48 pitch, 8 cutters to each pitch. The Epicycloidal are from 2 to 10 pitch, 24 to each pitch. The curves of gear cutters are obtained by machinery. SIDE MILLING CUTTERS, from 3 1-2 in. to 8 in. diameter, are carried in stock. On work having parallel surfaces, these cutters may be used in pairs FORMED CUTTERS, for cutting various outlines, are made to order. These, as also the Gear Cutters, can be sharpened without changing their original form—a feature appreciated by those producing work in duplicate. By making cutters in large numbers, with expensive special tools, much greater accuracy has been attained than can be reached by the usual methods of manufacture. Users of cutters will generally find it more economical and satisfactory to purchase from experienced makers, rather than to attempt to manufacture for themselves. Catalogues mailed on application. All kinds of cutters made to order.

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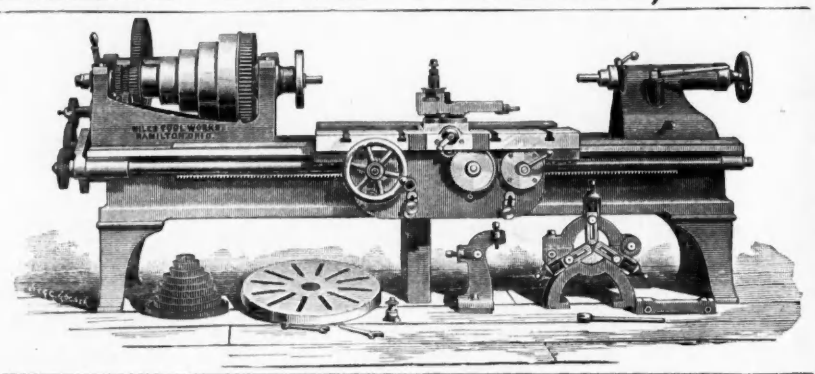

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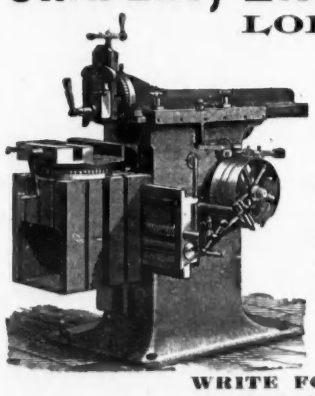

SHAPERS, 8", 10", 15", 20", 26", 32" Stroke.

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24 " " and
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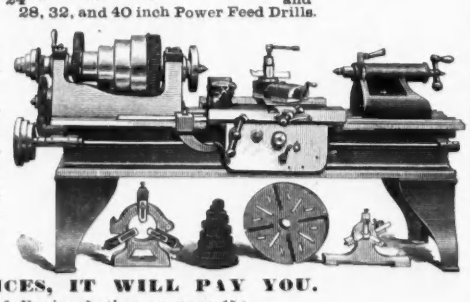

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(See special notice of Engine Lathes on page 15.)

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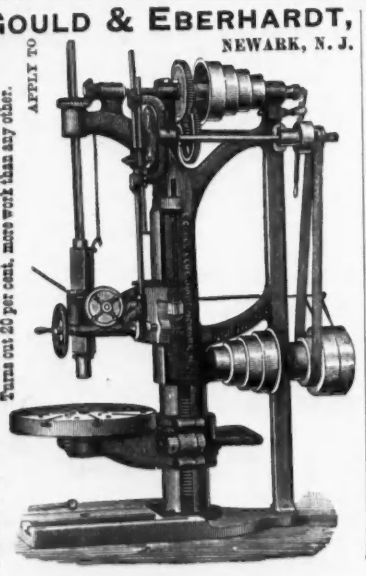

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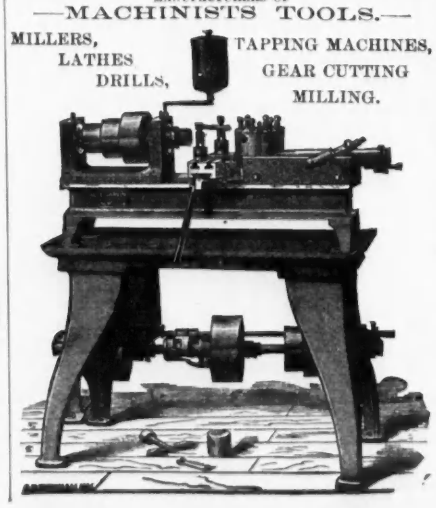

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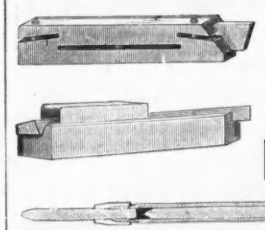

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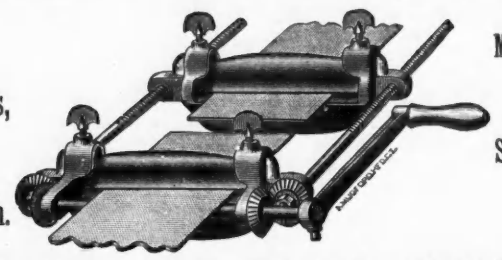

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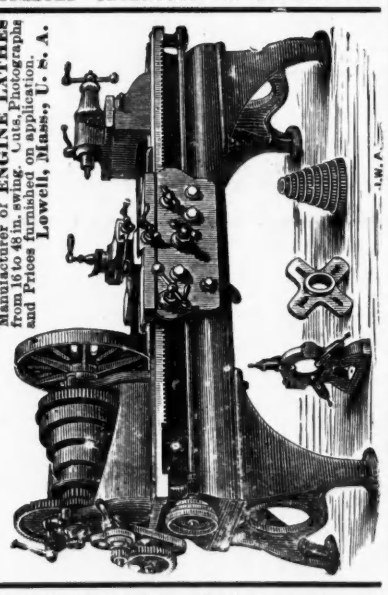

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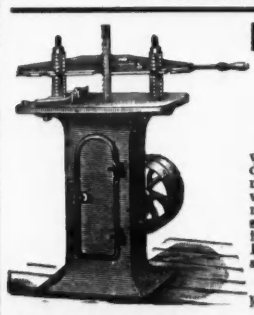

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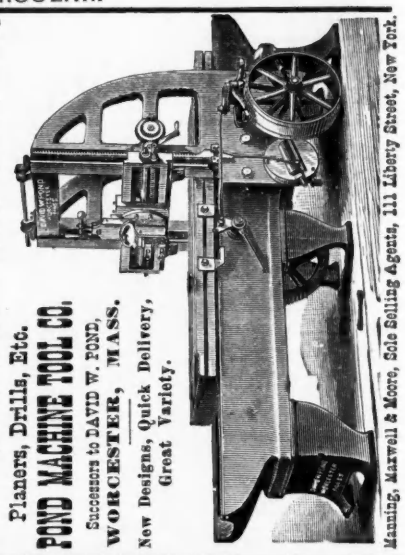

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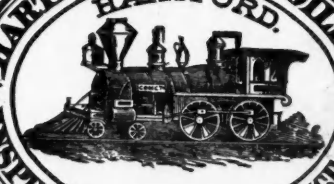

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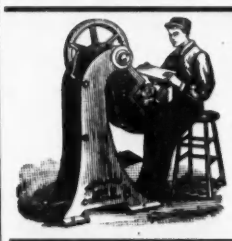

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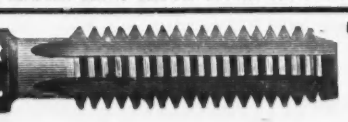

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